# FLOW OF LIQUID FUEL THROUGH ORIFICES

BY

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ARMOUR INSTITUTE OF TECHNOLOGY

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# AN INVESTIGATION OF THE FLOW OF LIQUID FUEL THROUGH ORIFICES

A THESIS

PRESENTED BY

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# PART 1.

## Object.

# AN INVESTIGATION OF THE FLOW OF LIQUID FUEL THROUGH ORIFICES.

The object of this thesis is the investigation of the flow of liquid fuel through orifices.

The fuel used throughout the investigation was kerosine oil. No attempts were made to conduct any test with any other oils, although the apparatus used and the system of calculation can easily be applied to any other fuel, such as alcohol, gasoline, agni-benzol or others.

In the testing of engines it is very desireable to know just how much fuel it is burning at any instant. At present the general method of determining fuel consumption in an engine is to measure the time and determine the weight of fuel used during that time, or to measure the fuel and determine the time. In either case there is much chance for error

because the running conditions may vary during the course of the run. An indicating device which would register any instantaneous change in flow would be the solution of the problem. With this perfected the cause of varition could be discovered and the best running conditions of the engine could be determined. An instrument of this kind would, therefore, be of much value.

With this idea in view, an attempt was made to build and calibrate an instrument or metering device which would register the required readings. A flow meter, the front elevation of which is shown in Fig.I. was the instrument constructed.

# PART 11.

## Apparatus.

The apparatus is as follows:- a 5 gallon tank of kerosine which has a pipe leading from its lower end into a carburetor D, Fig.I., 2 feet below. The float in D maintains the oil at a constant level so that the flow into the apparatus always is under one constant head. From here the oil flows through the pipe N, and through the orifices A and B into the carburetor E. From here the oil flows through the orifice C and out into a measuring glass.

The center line of the horizontal pipe leading to the carburetor E is 2.3 inches above the center line of the outlet pipe which holds the orifice C.

The so called orifices are standard pet-cocks. They have the regular opening and closing levers, and can be opened full amount or any fraction thereof. Flat pieces of brass were fastened under the control handle, and ordinary protractors were soldered onto these brass plates. The plan view of the apparatus

as shown Fig.II., shows how the protractors were connected.

An indicating pointer was attached to handle of the valve or orifice. By means of this pointer and protractor the opening and closing position of the orifice was determined. This was done by allowing the fuel to flow through the system. With two valves open the third handle was turned along the indicator until no fuel flowed out of C. This point was then marked as the closing position of orifice. The indicator showed the angle on protractor at this point.

The positions or angles of the opening and closing are given as follows for each orifice:-

| | A | B | C |
|---|---|---|---|
| Closed at | 47 deg. | 138 deg. | 127deg. |
| Opened 1 deg. at | 46 deg. | 139 deg. | 126deg. |

This means that when the indicator is over the angle indicated in the first row, the orifice A, B or C is just the closed position.

The second row shows the indicator position when the orifice is one degree open.

Fig.III. shows a section through the carburetors used in this apparatus. They are standard pieces, and can be replaced at any time. The fuel enters through the pipe at the lower right hand side, raises in tube F, and leaves at the lower left. These carburetors maintain a constant level of the fuel.

The center line through the pipe C was called the zero line. About 8 inches up from this line and leading out from the pipe E at right angles is a brass tube. Attached to this tube is one of glass which turns at right angles and goes straight up. This glass tube shows at all times what the level of the fuel is in the carburetor D.This also shows the head on the system at all times. It should be and is constant throughout all runs.

Half way between the two orifices A and B is a tube which leads up. About four inches up on this tube another tube leads off at right

angles. These tubes show at any instant what the head is above orifice B. Either the column F or G will show at any instant what this head is in inches of the fuel used in the test. The tube F is bent at an angle at top so that more accurate readings can be taken. When the column falls below the 19 inch line, the column G is read instead of F. This gives the same readings as column F.

Another tube is set up in the line between the carburetor E and the orifice C. This tube represents the head in the line just after the carburetor E and is called column H.

The whole apparatus is mounted on a wooden frame.

Utilizing the center line of C as a zero line, there is a scale graduated in inches set up on the frame under the column H, G, L and F. By means of this scale the heights of the fuel in these various columns can be read, and, therefore, the heads at any instant can be read at the various points in the line.

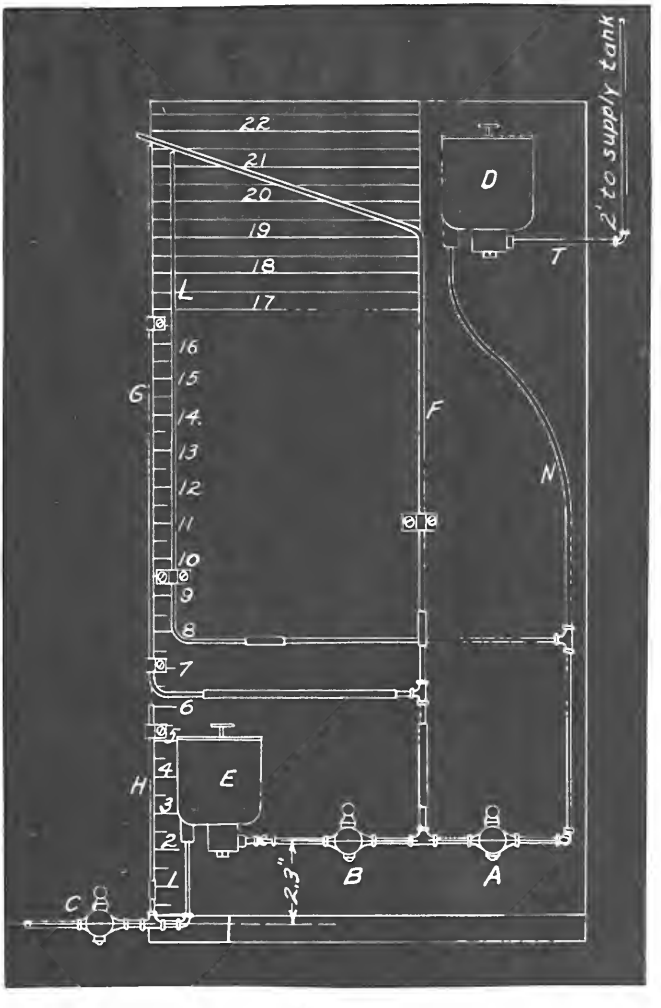
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Fig.1,

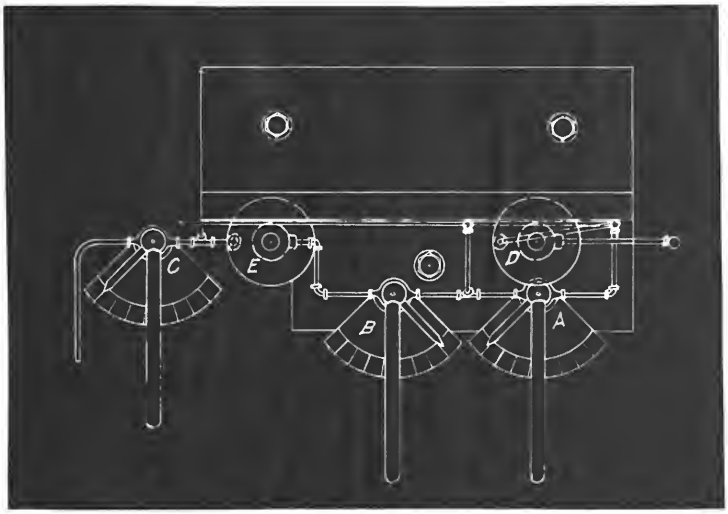


Fig. 11.

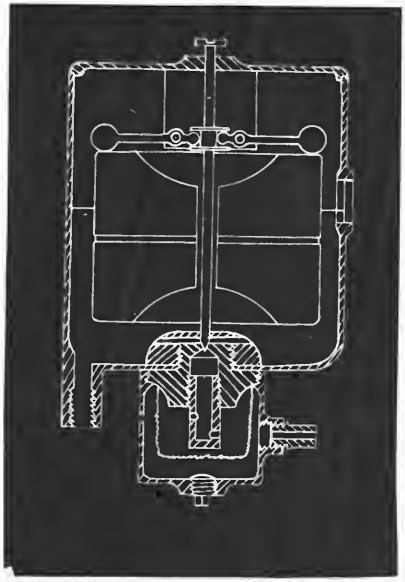

Fig. 111.

# PART 111.

## Proceedure.

The first step in conducting the test of this instrument was to determine the closing position of the orifices. The method of doing this was described in Part I. under apparatus. It was found that the largest opening of orifice A is 47 degrees. For orifice B it was found to be 36 degrees. For orifice C it was found to be 32 degrees. This means that these are the number of degrees on the protractor indicated by the pointer between the largest opening position and closing position for each orifice.

Runs were made with the orifices opened to various degrees on the protractors. The first test was made with the orifice A opened 47 degrees and B opened 36 degrees. The opening of orifice C was varied by four degree increments from the closed postion to the position of the largest. opening. This gives nine separate runs. The runs were of two minute duration and the fuel was measured in cubic centimeters at the end of each run.

When this test was completed, runs were

made with A open 47 degrees and B open 32 degrees. The next test was made with A open 47 degrees and B open 28 degrees. This was continued until B was closed. A was then closed to 43 degrees and the same process was gone through. During each separate run the orifice C was varied four degrees, from 32 degrees open to closed. In these tests there were 12 different positions of the orifice A, 9 positions of the orifice B, for every position of A, and 8 positions of orifice for every position of B. This totals up to 8 x 9 x 12 or 864 runs.

The readings taken for each run were as follows:-

Degrees opening of A.

Degrees opening of B.

Degrees opening of C.

Height of column F or G.

Height of column L.

Height of column H.

Number of cubic centimeters of fuel which flowed through the orifice.

The temperature of the oil.

A Baumé reading was taken the first day that runs were made, and the specific gravity calculated for each run.

# PART IV.

## Calculations.

The following formula was used to calculate the specific gravity of the oil for the various temperatures.

$$\text{Specific gravity} = \frac{141.5}{131.5 + \text{deg. Baumé}}$$

60 degrees Fahrenheit, standard.

Degrees Baumé vary one degree Baumé for every ten degrees Fahrenheit change in temperature.

Example:

At 71.5 degrees Fahrenheit the Baumé was 43.2 degrees.

$$\text{Sp. gr. at 71.5 deg. Fahr.} = \frac{141.5}{131.5 + 43.2}$$

$$= .80996$$

At 60 degrees Fahrenheit the Baumé reading is $43.2 - \frac{71.5 - 60}{10} = 42.05$

$$\text{The sp.gr. is } \frac{141.5}{131.5 + 42.05} = .81562$$

To calculate the pounds of kerosene per hour, the following method was used.

$$\text{Lb./hr.} = \frac{\text{sp.gr.} \times .002203 \times \text{C.C.} \times 60}{T}$$

.002203 = the weight, in pounds of one C.C. of water.

C.C. = the cubic centimeters of kerosene which flowed in the time T.

T = the time of flow in minutes.

For two minute runs the formula reduces to:-

$$\text{Lb./hr.} = \frac{\text{sp.gr.} \times .002203 \times \text{C.C.} \times 60}{2}$$

$$= 0.06609 \times \text{C.C.} \times \text{sp. gr.}$$

# PART V.

## An Automatic Weighing and Recording Device.

The large figure in the back cover shows a very accurate and convenient apparatus for weighing a definite amount of fuel; the watch shown, automatically recording the time of flow. This apparatus was built in the electrical laboratory of Armour Institute, and operates as follows:-

Running, no testing.

Switch to Right.

As gasoline is used, tank gets lighter and rises- this makes rear contact and opens supply valve. Tank will fill until it drops and breaks contact. This stops gasoline supply. The tank now gets lighter as gasoline is being used- then operation repeats.

Testing.

Switch to Left.

Now supply valve always remains closed. As fuel is used, tank gets lighter and raises- this makes front contact and starts the watch. Move the switch to the off postion. Put one-half pound weight under tank- put switch on

testing position (to left again). The tank will now rise when the one-half pound of gasoline has been used. This makes front contact the second time and stops the watch. Take the reading and turn the switch to the right and remove the one-half pound test weight.

# PART VI.

## Data and Curves.

Figures 1 to 12 are drawn with H constant for each curve.

With a given opening of valves A, B and C, the height of column F can be found by referring to proper curve.

Example.

Given C= 20 deg. open.

" A= 43 deg. "

" B= 28 deg. "

From Fig. 2., curve III. F is found to be 19.7 inches.

Figures 13 to 24 are drawn with H constant for each curve.

Knowing the postion of valves A and B and the height of column F, we can go to curves 13 to 24 and determine the pounds oil flowing per hour.

Example.

Given F = 20 inches.

" A = 43 degrees open.

" B = 28 degrees open.

From figure 14, curve III. ,it is found

that 24 pounds of kerosine flow per hour.

Figures 25 to 34 are drawn with F constant for each curve.

With a given opening of valves A and B and the height of column F, we can go to the curves and find the number of pounds of kerosine which are flowing per hour.

Example.

Given F = 19 inches.

" B = 28 deg. open.

" A = 30 deg. open.

From figure 27, curve IV., it is found that 32.5 pounds of kerosine flow per hour.

Figures 34 is drawn with B constant for each curve.

Knowing the height of column F and the position of A, and B is open 36 degrees, we can refer to the figure and find the number of pounds of fuel which flow per hour.

Example.

Given F = 24 inches.

" A = 15 deg. open.

=

=

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Given B = 36 deg. open.

From figure 34, curve IX., it is found that 20 pounds of kerosine flow per hour.

Figure 35 is figure 34 drawn to a larger scale. The points for F = 17 were taken directly from figure 34.

Table 1.

"A" open 47 deg. 76 deg. Fahr.
"B" open 36 deg. 5 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.50 | 0 | 0.00 |
| 4 | 20.85 | 20.79 | 4.42 | 108 | 2.33 |
| 8 | 20.82 | 20.74 | 4.39 | 301 | 6.50 |
| 12 | 20.79 | 20.55 | 4.30 | 535 | 11.54 |
| 16 | 20.72 | 20.20 | 4.20 | 893 | 19.25 |
| 20 | 20.50 | 19.70 | 3.90 | 1300 | 28.00 |
| 24 | 20.30 | 19.05 | 3.60 | 1734 | 37.40 |
| 28 | 20.05 | 18.30 | 3.20 | 2190 | 47.30 |
| 32 | 19.80 | 17.70 | 2.50 | 2520 | 54.40 |

Table 2.

"A" open 47 deg. 74 deg. Fahr.
"B" open 32 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.80 | ---- | 43 | 2.32 |
| 8 | 20.80 | 20.66 | ---- | 118 | 6.37 |
| 12 | ----- | 20.40 | 4.40 | 214 | 11.54 |
| 16 | ----- | 20.20 | ---- | 354 | 19.10 |
| 20 | 20.52 | 19.65 | 3.95 | 519 | 28.00 |
| 24 | ----- | 19.00 | ---- | 702 | 37.90 |
| 28 | ----- | 18.20 | 3.35 | 870 | 46.90 |
| 32 | 19.00 | 17.10 | ---- | 920 | 49.60 |

Table 3.

"A" open 47 deg. 74 deg. Fahr.
"B" open 28 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 29.90 | 29.90 | 4.70 | 0 | 0.00 |
| 4 | ----- | 20.79 | ---- | 42 | 2.26 |
| 8 | ----- | 20.70 | ---- | 125 | 6.75 |
| 12 | ----- | 20.48 | ---- | 214 | 11.54 |
| 16 | 20.70 | 20.35 | 4.20 | 349 | 18.80 |
| 20 | ----- | 19.70 | ---- | 513 | 27.65 |
| 24 | 20.35 | 19.06 | 3.54 | 693 | 37.40 |
| 28 | ----- | 18.38 | ---- | 866 | 46.70 |
| 32 | 19.98 | 18.24 | ---- | 918 | 49.56 |

Table 4.

"A" open 47 deg. 74 deg. Fahr.
"B" open 24 deg. 2min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.70 | 0 | 0.00 |
| 4 | ----- | 20.76 | ---- | 42 | 2.66 |
| 8 | ----- | 20.66 | ---- | 118 | 6.27 |
| 12 | 20.74 | 20.46 | 4.33 | 216 | 11.64 |
| 16 | ----- | 20.20 | ---- | 353 | 19.05 |
| 20 | 20.55 | 19.70 | 3.90 | 514 | 27.70 |
| 24 | ----- | 19.10 | ---- | 695 | 37.50 |
| 28 | ----- | 18.68 | 2.60 | 816 | 44.00 |
| 32 | 20.10 | 19.64 | ---- | 799 | 43.10 |

Table 5.

"A" open 47 deg. 74 deg. Fahr.
"B" open 20 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.70 | 0 | 0.00 |
| 4 | ----- | 20.78 | ---- | 42 | 2.26 |
| 8 | ----- | 20.66 | ---- | 114 | 6.15 |
| 12 | 20.74 | 20.50 | 4.38 | 215 | 11.60 |
| 16 | ----- | 20.30 | ---- | 352 | 19.00 |
| 20 | ----- | 19.70 | ---- | 514 | 27.70 |
| 24 | ----- | 19.15 | ---- | 676 | 36.40 |
| 28 | 20.30 | 19.15 | ----- | 694 | 37.40 |
| 32 | 20.30 | 19.15 | ---- | 660 | 35.60 |

Table 6.

"A" open 47 deg. 74 deg. Fahr.
"B" open 16 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.70 | 0 | 0.00 |
| 4 | ----- | 20.78 | ---- | 43 | 2.32 |
| 8 | ----- | 20.66 | ---- | 117 | 6.32 |
| 12 | 20.74 | 20.48 | 4.32 | 213 | 11.50 |
| 16 | ----- | 20.30 | ---- | 345 | 18.60 |
| 20 | ----- | 19.70 | ---- | 510 | 27.50 |
| 24 | ----- | 19.68 | ---- | 548 | 29.60 |
| 28 | 20.50 | 19.68 | ---- | 524 | 28.30 |
| 32 | ----- | 19.68 | ---- | 509 | 27.50 |

[illegible]

[illegible]

Table 7.

"A" open 47 deg. 74 deg. Fahr.
"B" open 12 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.70 | 0 | 0.00 |
| 4 | ----- | 20.75 | ---- | 45 | 2.42 |
| 8 | ----- | 20.65 | ---- | 119 | 6.42 |
| 12 | 20.70 | 20.48 | 4.35 | 212 | 11.45 |
| 16 | ----- | 20.30 | ---- | 348 | 18.75 |
| 20 | 20.70 | 20.19 | ---- | 386 | 20.80 |
| 24 | 20.70 | 20.19 | ---- | 355 | 19.15 |
| 28 | 20.70 | 20.19 | ---- | 355 | 19.15 |
| 32 | 20.70 | 20.19 | ---- | 355 | 19.15 |

Table 8.

"A" open 47 deg. 74 deg. Fahr.
"B" open 8 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.70 | 0 | 0.00 |
| 4 | ----- | 20.75 | ---- | 44 | 2.38 |
| 8 | 20.80 | 20.63 | 4.40 | 119 | 6.42 |
| 12 | ----- | 20.52 | ---- | 205 | 11.05 |
| 16 | 20.75 | 20.50 | ---- | 200 | 10.80 |
| 20 | 20.75 | 20.50 | ---- | 185 | 10.00 |
| 24 | 20.75 | 20.50 | ---- | 185 | 10.00 |
| 28 | 20.75 | 20.50 | ---- | 185 | 10.00 |
| 32 | 20.75 | 20.50 | ---- | 185 | 10.00 |

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Table 9.

"A" open 47 deg. 75 deg. Fahr.
"B" open 4 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.63 | 0 | 0.00 |
| 4 | ----- | 20.78 | ---- | 44 | 2.38 |
| 8 | ----- | 20.70 | ---- | 72 | 3.88 |
| 12 | 20.80 | 20.70 | ---- | 73 | 3.93 |
| 16 | 20.80 | 20.70 | ---- | 72 | 3.88 |
| 20 | 20.80 | 20.70 | ----- | 72 | 3.88 |
| 24 | 20.80 | 20.70 | ---- | 72 | 3.88 |
| 28 | 20.80 | 20.70 | ---- | 72 | 3.88 |
| 32 | 20.80 | 20.70 | ---- | 72 | 3.88 |

Table 10.

"A" open 43 deg. 75 deg. Fahr.
"B" open 36 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.70 | 0 | 0.00 |
| 4 | ----- | 20.75 | 4.60 | 45 | 2.43 |
| 8 | ----- | 20.60 | ---- | 119 | 6.43 |
| 12 | 20.70 | 20.43 | 4.40 | 215 | 11.60 |
| 16 | ----- | 20.20 | ---- | 358 | 19.35 |
| 20 | ----- | 19.68 | ---- | 516 | 27.90 |
| 24 | 20.80 | 19.04 | 3.60 | 692 | 37.40 |
| 28 | ----- | 18.15 | 3.18 | 870 | 47.00 |
| 32 | ----- | 17.95 | ---- | 908 | 49.00 |

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Table 11.

"A" open 43 deg. 79 deg. Fahr.
"B" open 32 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.80 | ---- | 43 | 2.30 |
| 8 | ----- | 20.70 | ---- | 115 | 6.14 |
| 12 | ----- | 20.43 | 4.30 | 230 | 12.28 |
| 16 | 20.70 | 20.30 | ---- | 351 | 18.75 |
| 20 | ----- | 19.78 | ---- | 520 | 27.80 |
| 24 | ----- | 19.06 | ---- | 708 | 37.80 |
| 28 | ----- | 18.78 | ---- | 837 | 44.70 |
| 32 | 20.14 | 18.78 | ---- | 798 | 42.60 |

Table 12.

"A" open 43 deg. 79 deg. Fahr.
"B" open 28 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.78 | ---- | 44 | 2.35 |
| 8 | ----- | 20.68 | ---- | 119 | 6.36 |
| 12 | ----- | 20.47 | ---- | 225 | 12.00 |
| 16 | 20.50 | 20.28 | 4.20 | 359 | 19.15 |
| 20 | ----- | 19.80 | ---- | 522 | 27.90 |
| 24 | 20.30 | 19.15 | 3.58 | 692 | 37.00 |
| 28 | 20.25 | 19.00 | ---- | 812 | 43.35 |
| 32 | 20.25 | 19.00 | ---- | 705 | 37.65 |

Table 13.

"A" open 43 deg. 79 deg. Fahr.
"B" open 24 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.79 | ---- | 44 | 2.35 |
| 8 | ----- | 20.64 | ---- | 118 | 6.30 |
| 12 | 20.76 | 20.48 | 4.38 | 220 | 11.75 |
| 16 | ----- | 20.28 | ---- | 360 | 19.40 |
| 20 | 20.50 | 19.65 | 3.78 | 564 | 30.10 |
| 24 | ----- | 19.30 | ---- | 709 | 37.90 |
| 28 | 20.38 | 19.30 | ---- | 695 | 37.10 |
| 32 | 20.38 | 19.30 | ---- | 638 | 34.10 |

Table 14.

"A" open 43 deg. 79 deg. Fahr.
"B" open 20 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.79 | ---- | 44 | 2.35 |
| 8 | ----- | 20.70 | ---- | 116 | 6.20 |
| 12 | ----- | 20.49 | ---- | 233 | 12.43 |
| 16 | ----- | 20.35 | ---- | 354 | 18.90 |
| 20 | ----- | 19.78 | ---- | 516 | 27.55 |
| 24 | 20.47 | 19.63 | 2.90 | 638 | 34.10 |
| 28 | ----- | 19.63 | ---- | 573 | 30.60 |
| 32 | 20.47 | 19.63 | ---- | 562 | 30.00 |

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Table 15.

"A" open 43 deg. 79 deg. Fahr.
"B" open 16 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.78 | ---- | 45 | 2.40 |
| 8 | ----- | 20.70 | ---- | 119 | 6.36 |
| 12 | 20.70 | 20.50 | 4.30 | 234 | 12.50 |
| 16 | ----- | 20.29 | ---- | 366 | 19.55 |
| 20 | ----- | 20.00 | ---- | 478 | 25.50 |
| 24 | 20.60 | 20.00 | ---- | 458 | 24.45 |
| 28 | ----- | 20.00 | ---- | 438 | 23.40 |
| 32 | 20.60 | 20.00 | ---- | 442 | 23.60 |

Table 16.

"A" open 43 deg. 79 deg. Fahr.
"B" open 12 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.78 | ---- | 45 | 2.40 |
| 8 | ----- | 20.68 | ---- | 118 | 6.30 |
| 12 | 20.70 | 20.57 | 4.38 | 232 | 12.40 |
| 16 | 20.70 | 20.36 | ---- | 335 | 17.90 |
| 20 | 20.70 | 20.36 | ---- | 346 | 18.47 |
| 24 | 20.70 | 20.36 | ---- | 316 | 16.88 |
| 28 | 20.70 | 20.36 | ---- | 314 | 16.75 |
| 32 | 20.70 | 20.36 | ---- | 315 | 16.85 |

Table 17

"A" open 43 deg. 79 deg. Fahr.
"B" open 8 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.79 | ---- | 45 | 2.40 |
| 8 | ----- | 20.68 | ---- | 116 | 6.20 |
| 12 | 20.76 | 20.58 | 4.20 | 230 | 12.28 |
| 16 | 20.76 | 20.58 | ---- | 229 | 12.20 |
| 20 | 20.76 | 20.58 | ---- | 182 | 9.73 |
| 24 | 20.76 | 20.58 | ---- | 182 | 9.73 |
| 28 | 20.76 | 20.58 | ---- | 182 | 9.73 |
| 32 | 20.76 | 20.58 | ---- | 182 | 9.73 |

Table 18

"A" open 43 deg. 79 deg. Fahr.
"B" open 4 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.78 | ---- | 46 | 2.46 |
| 8 | ----- | 20.74 | 3.80 | 114 | 6.09 |
| 12 | 20.80 | 20.74 | ---- | 90 | 4.80 |
| 16 | ----- | 20.74 | ---- | 67 | 3.58 |
| 20 | 20.80 | 20.74 | ---- | 66 | 3.52 |
| 24 | 20.80 | 20.74 | ---- | 66 | 3.52 |
| 28 | 20.80 | 20.74 | ---- | 66 | 3.52 |
| 32 | 20.80 | 20.74 | ---- | 66 | 3.52 |

Table 19

"A" open 39 deg. 75 deg. Fahr.
"B" open 36 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lbs. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.78 | ---- | 44 | 2.38 |
| 8 | ----- | 20.67 | ---- | 121 | 6.54 |
| 12 | 20.77 | 20.45 | 4.40 | 215 | 11.60 |
| 16 | ----- | 20.15 | ---- | 355 | 19.20 |
| 20 | ----- | 19.65 | ---- | 527 | 28.50 |
| 24 | 20.20 | 18.96 | 3.53 | 705 | 38.10 |
| 28 | 15.60 | 18.00 | ---- | 865 | 46.75 |
| 32 | 14.50 | 17.90 | ---- | 905 | 48.90 |

Table 20.

"A" open 39 deg. 71.5 deg. Fahr.
"B" open 32 deg. 2 min runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.79 | ---- | 45 | 2.41 |
| 8 | ----- | 20.68 | ---- | 116 | 6.22 |
| 12 | ----- | 20.46 | ---- | 224 | 12.00 |
| 16 | 20.74 | 20.18 | 4.20 | 348 | 18.65 |
| 20 | ----- | 19.68 | ---- | 517 | 27.50 |
| 24 | ----- | 18.92 | ---- | 690 | 37.00 |
| 28 | 20.20 | 18.75 | 2.90 | 828 | 44.40 |
| 32 | ----- | 18.75 | ---- | 766 | 41.10 |

Table 21.

"A" open 39 deg. 71.5 Deg. Fahr.
"B" open 28 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.78 | ---- | 44 | 2.36 |
| 8 | ----- | 20.70 | ---- | 117 | 6.28 |
| 12 | 20.76 | 20.46 | 4.36 | 226 | 12.10 |
| 16 | ----- | 20.24 | ---- | 352 | 18.90 |
| 20 | ------ | 19.70 | ---- | 520 | 27.90 |
| 24 | 20.32 | 19.00 | 3.48 | 690 | 37.00 |
| 28 | ----- | 18.90 | ---- | 780 | 41.80 |
| 32 | ----- | 18.90 | ---- | 699 | 37.50 |

Table 22.

"A" open 39 deg. 71.5 Deg. Fahr.
"B" open 24 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.79 | ---- | 44 | 2.36 |
| 8 | ----- | 20.69 | ---- | 117 | 6.28 |
| 12 | ----- | 20.50 | ---- | 225 | 12.05 |
| 16 | ----- | 20.20 | ---- | 359 | 19.25 |
| 20 | ----- | 19.70 | ---- | 518 | 27.80 |
| 24 | 20.40 | 19.24 | 3.40 | 670 | 35.90 |
| 28 | ----- | 19.20 | ---- | 677 | 36.30 |
| 32 | ----- | 19.25 | ---- | 644 | 34.50 |

Table 23.

"A" open 39 deg. 71.5 Deg.Fahr.
"B" open 20 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.80 | ---- | 45 | 2.41 |
| 8 | ----- | 20.68 | ---- | 116 | 6.22 |
| 12 | ----- | 20.44 | ---- | 224 | 12.00 |
| 16 | 20.70 | 20.25 | 4.17 | 361 | 19.35 |
| 20 | ------ | 19.75 | ---- | 513 | 27.50 |
| 24 | ----- | 19.56 | ---- | 590 | 31.65 |
| 28 | 20.50 | 19.56 | ---- | 560 | 30.00 |
| 32 | ----- | 19.56 | ----- | 546 | 29.30 |

Table 24.

"A" open 39 deg. 71.5 Deg. Fahr.
"B" open 16 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.79 | ---- | 45 | 2.41 |
| 8 | ----- | 20.69 | ----- | 117 | 6.28 |
| 12 | ----- | 20.55 | ---- | 224 | 12.00 |
| 16 | ----- | 20.35 | ---- | 360 | 19.30 |
| 20 | ----- | 19.98 | ----- | 488 | 26.20 |
| 24 | 20.60 | 19.98 | ---- | 477 | 25.60 |
| 28 | ----- | 19.98 | ----- | 448 | 24.00 |
| 32 | ----- | 19.98 | ---- | 436 | 23.35 |

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| [illegible] | [illegible] | [illegible] |

Table 25.

"A" open 39 deg. 71.5 Deg. Fahr.
"B" open 12 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.79 | ---- | 44 | 2.47 |
| 8 | ----- | 20.69 | ---- | 113 | 6.07 |
| 12 | ----- | 20.50 | ---- | 220 | 11.08 |
| 16 | 20.70 | 20.35 | ---- | 254 | 13.60 |
| 20 | 20.70 | 20.35 | ---- | 256 | 13.70 |
| 24 | 20.70 | 20.35 | ---- | 319 | 17.10 |
| 28 | 20.70 | 20.35 | ---- | 319 | 17.10 |
| 32 | 20.70 | 20.35 | ---- | 319 | 17.10 |

Table 26.

"A" open 39 deg. 71.5 Deg. Fahr.
"B" open 8 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.80 | ---- | 45 | 2.41 |
| 8 | ----- | 20.67 | ---- | 118 | 6.34 |
| 12 | 20.75 | 20.58 | 4.00 | 206 | 11.05 |
| 16 | 20.75 | 20.58 | ---- | 237 | 12.70 |
| 20 | 20.75 | 20.58 | ---- | 194 | 10.40 |
| 24 | 20.75 | 20.58 | ---- | 172 | 9.23 |
| 28 | 20.75 | 20.58 | ---- | 172 | 9.23 |
| 32 | 20.75 | 20.58 | ---- | 172 | 9.23 |

Table 27.

"A" open 39 deg. 71.5 Deg. Fahr.
"B" open 4 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.78 | ---- | 43 | 2.31 |
| 8 | 20.83 | 20.78 | ----- | 108 | 5.80 |
| 12 | 20.83 | 20.78 | ---- | 88 | 4.73 |
| 16 | 20.83 | 20.78 | ---- | 64 | 3.43 |
| 20 | 20.83 | 20.78 | ---- | 64 | 3.43 |
| 24 | 20.83 | 20.78 | ---- | 64 | 3.43 |
| 28 | 20.83 | 20.78 | ---- | 64 | 3.43 |
| 32 | 20.83 | 20.78 | ---- | 64 | 3.43 |

Table 28:

"A" open 35 deg. 71.5 Deg. Fahr.
"B" open 36 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.76 | ---- | 43 | 2.31 |
| 8 | 20.70 | 20.65 | 4.40 | 119 | 6.43 |
| 12 | ----- | 20.45 | ---- | 215 | 11.60 |
| 16 | ----- | 20.15 | ---- | 350 | 18.90 |
| 20 | 20.54 | 19.60 | 3.90 | 525 | 28.40 |
| 24 | ----- | 18.85 | ---- | 705 | 38.10 |
| 28 | 20.05 | 18.00 | 3.00 | 865 | 46.75 |
| 32 | ----- | 17.90 | ---- | 910 | 49.80 |

Table 29.

"A" open 35 deg. 71.5 Deg Fahr.
"B" open 32 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.78 | ---- | 45 | 2.41 |
| 8 | ----- | 20.68 | ---- | 124 | 6.66 |
| 12 | ----- | 20.50 | ---- | 210 | 11.27 |
| 16 | 20.70 | 20.15 | 4.20 | 350 | 18.80 |
| 20 | ----- | 19.57 | ---- | 521 | 27.95 |
| 24 | ----- | 19.26 | ---- | 672 | 36.10 |
| 28 | 20.40 | 19.20 | ---- | 660 | 35.40 |
| 32 | 20.40 | 19.20 | ---- | 622 | 33.40 |

Table 30.

"A" open 35 deg. 71.5 Deg. Fahr.
"B" open 28 deg. 2 Min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.78 | ---- | 45 | 4.41 |
| 8 | ----- | 20.68 | ---- | 124 | 6.66 |
| 12 | ----- | 20.50 | ---- | 210 | 11.27 |
| 16 | 20.70 | 20.15 | 4.20 | 350 | 18.80 |
| 20 | ----- | 19.57 | ---- | 521 | 27.95 |
| 24 | ----- | 19.26 | ---- | 672 | 36.10 |
| 28 | 20.40 | 19.20 | ---- | 660 | 35.40 |
| 32 | 20.40 | 19.20 | ---- | 622 | 33.40 |

Table 31.

"A" open 35 deg. 71.5 Deg. Fahr.
"B" open 24 deg. 2 min.runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.79 | ---- | 44 | 2.36 |
| 8 | ----- | 20.68 | ---- | 119 | 6.43 |
| 12 | 20.78 | 20.50 | 4.37 | 212 | 11.40 |
| 16 | ----- | 20.20 | ---- | 362 | 19.40 |
| 20 | ----- | 19.67 | ---- | 510 | 27.40 |
| 24 | 20.48 | 19.40 | ---- | 646 | 34.65 |
| 28 | 20.48 | 19.40 | ---- | 582 | 31.20 |
| 32 | 20.48 | 19.40 | ---- | 576 | 30.90 |

Table 32.

"A" open 35 deg. 71.5 Deg. Fahr.
"B" open 20 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.78 | ---- | 45 | 2.41 |
| 8 | ----- | 20.68 | ---- | 116 | 6.22 |
| 12 | 20.79 | 20.52 | 4.38 | 212 | 11.40 |
| 16 | ----- | 20.23 | ---- | 357 | 29.90 |
| 20 | 20.55 | 19.78 | ----- | 503 | 27.00 |
| 24 | 20.55 | 19.70 | ---- | 560 | 30.00 |
| 28 | 20.55 | 19.70 | ----- | 517 | 27.75 |
| 32 | 20.55 | 19.70 | ---- | 500 | 26.80 |

Table 33.

"A" open 35 deg. 71.5 Deg. Fahr.
"B" open 16 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb per Hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.78 | ---- | 45 | 2.41 |
| 8 | ----- | 20.66 | ---- | 117 | 6.28 |
| 12 | ----- | 20.52 | ---- | 234 | 12.55 |
| 16 | 20.70 | 20.28 | 4.10 | 352 | 18.90 |
| 20 | 20.65 | 20.05 | 3.30 | 490 | 26.30 |
| 24 | 20.65 | 20.05 | ---- | 420 | 22.55 |
| 28 | 20.65 | 20.05 | ---- | 420 | 22.55 |
| 32 | 20.65 | 20.05 | ---- | 420 | 22.55 |

Table 34.

"A" open 35 deg. 71.5 deg. Fahr.
"B" open 12 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.79 | ---- | 45 | 2.41 |
| 8 | ----- | 20.68 | ---- | 115 | 6.17 |
| 12 | 20.75 | 20.50 | 4.30 | 237 | 12.70 |
| 16 | 20.75 | 20.40 | ---- | 450 | 24.15 |
| 20 | 20.75 | 20.40 | ---- | 340 | 18.25 |
| 24 | 20.75 | 20.40 | ---- | 310 | 16.65 |
| 28 | 20.75 | 20.40 | ---- | 300 | 16.10 |
| 32 | 20.75 | 20.40 | ---- | 300 | 16.10 |

Table 35.

"A" open 35 deg. 71.5 Deg. Fahr.
"B" open 8 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.79 | ---- | 46 | 2.47 |
| 8 | 20.80 | 20.65 | ---- | 114 | 6.12 |
| 12 | 20.80 | 20.65 | 4.00 | 213 | 11.43 |
| 16 | 20.80 | 20.65 | ---- | 228 | 12.23 |
| 20 | 20.80 | 20.65 | ---- | 184 | 9.89 |
| 24 | 20.80 | 20.65 | ---- | 172 | 9.24 |
| 28 | 20.80 | 20.65 | ---- | 172 | 9.24 |
| 32 | 20.80 | 20.65 | ---- | 172 | 9.24 |

Table 36.

"A" open 35 deg. 71.5 Deg. Fahr.
"B" open 4 deg. 2 min runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | 20.85 | 20.82 | 4.00 | 40 | 2.14 |
| 8 | 20.85 | 20.82 | ---- | 98 | 5.26 |
| 12 | 20.85 | 20.82 | ----- | 67 | 3.60 |
| 16 | 20.85 | 20.82 | ---- | 64 | 3.44 |
| 20 | 20.85 | 20.82 | ---- | 64 | 3.44 |
| 24 | 20.85 | 20.82 | ----- | 64 | 3.44 |
| 28 | 20.85 | 20.82 | ---- | 64 | 3.44 |
| 32 | 20.85 | 20.82 | ---- | 64 | 3.44 |

Table 37.

"A" open 31 deg. 71.5 deg. Fahr.
"B" open 36 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.77 | ---- | 45 | 2.41 |
| 8 | ----- | 20.66 | ---- | 120 | 6.49 |
| 12 | 20.73 | 20.47 | 4.40 | 210 | 11.35 |
| 16 | ----- | 20.10 | ---- | 355 | 19.20 |
| 20 | ----- | 19.30 | ---- | 525 | 28.40 |
| 24 | ----- | 18.35 | ---- | 710 | 38.40 |
| 28 | 20.10 | 17.55 | 2.80 | 830 | 44.85 |
| 32 | ----- | 17.53 | ---- | 840 | 45.40 |

Table 38.

"A" open 31 deg. 71.5 deg. Fahr.
"B" open 32 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.79 | ---- | 44 | 2.36 |
| 8 | ----- | 20.60 | ---- | 114 | 6.12 |
| 12 | ----- | 20.46 | ---- | 212 | 11.40 |
| 16 | 20.70 | 20.14 | 4.20 | 352 | 18.90 |
| 20 | ----- | 19.40 | ----- | 520 | 27.90 |
| 24 | 20.42 | 18.90 | ---- | 696 | 37.30 |
| 28 | 20.42 | 18.90 | ---- | 634 | 34.05 |
| 32 | 20.42 | 18.90 | ---- | 610 | 32.75 |

Table 39.

"A" open 31 deg. 71.5 Deg. Fahr.
"B" open 28 deg. 2 Min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.78 | ---- | 45 | 2.41 |
| 8 | ----- | 20.70 | ---- | 118 | 6.34 |
| 12 | 20.80 | 20.50 | 4.38 | 217 | 11.65 |
| 16 | ----- | 20.11 | ---- | 352 | 18.90 |
| 20 | ----- | 19.42 | ---- | 515 | 27.65 |
| 24 | 20.48 | 19.18 | ----- | 652 | 35.00 |
| 28 | 20.48 | 19.18 | ---- | 594 | 31.90 |
| 32 | 20.48 | 19.18 | ---- | 566 | 30.40 |

Table 40.

"A" open 31 deg. 71.5 Deg Fahr.
"B" open 24 deg. 2 Min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.79 | ---- | 45 | 2.41 |
| 8 | ----- | 20.74 | ---- | 118 | 6.34 |
| 12 | ----- | 20.50 | ---- | 230 | 12.35 |
| 16 | 20.72 | 20.10 | 4.15 | 352 | 18.90 |
| 20 | ----- | 19.43 | ---- | 520 | 27.90 |
| 24 | 20.55 | 19.35 | ---- | 592 | 31.80 |
| 28 | 20.55 | 19.35 | ---- | 546 | 29.30 |
| 32 | 20.55 | 19.35 | ---- | 526 | 28.20 |

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Table 41.

"A" open 31 deg. 71.5 Deg.Fahr.
"B" open 20 deg. 2 Min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.77 | ---- | 44 | 2.36 |
| 8 | ----- | 20.72 | ---- | 115 | 6.17 |
| 12 | ----- | 20.53 | ---- | 214 | 11.50 |
| 16 | ----- | 20.11 | ---- | 360 | 19.30 |
| 20 | 20.60 | 19.69 | 3.65 | 508 | 27.30 |
| 24 | 20.60 | 19.69 | ---- | 505 | 27.10 |
| 28 | 20.60 | 19.69 | ---- | 464 | 24.90 |
| 32 | 20.60 | 19.69 | ---- | 464 | 24.90 |

Table 42.

"A" open 31 deg. 71.5 Deg. Fahr.
"B" open 16 deg. 2 Min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.78 | ---- | 45 | 2.41 |
| 8 | ----- | 20.70 | ---- | 116 | 6.22 |
| 12 | 20.75 | 20.50 | 4.38 | 214 | 11.50 |
| 16 | ----- | 20.10 | ---- | 350 | 18.80 |
| 20 | 20.70 | 20.00 | ---- | 460 | 24.70 |
| 24 | 20.70 | 20.00 | ---- | 388 | 20.80 |
| 28 | 20.70 | 20.00 | ---- | 384 | 20.60 |
| 32 | 20.70 | 20.00 | ---- | 384 | 20.60 |

Table 43.

"A" open 31 deg. 71.5 deg. Fahr.
"B" open 12 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.79 | ---- | 45 | 2.41 |
| 8 | ----- | 20.72 | ---- | 115 | 6.17 |
| 12 | 20.78 | 20.40 | 4.40 | 218 | 11.70 |
| 16 | 20.78 | 20.38 | ---- | 322 | 17.30 |
| 20 | 20.78 | 20.38 | ---- | 290 | 15.55 |
| 24 | 20.78 | 20.38 | ---- | 285 | 15.30 |
| 28 | 20.78 | 20.38 | ---- | 285 | 15.30 |
| 32 | 20.78 | 20.38 | ---- | 285 | 15.30 |

Table 44.

"A" open 31 deg. 71.5 deg. Fahr.
"B" open 8 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0. | 0.00 |
| 4 | ----- | 20.80 | ---- | 45 | 2.41 |
| 8 | ----- | 20.70 | ---- | 117 | 6.28 |
| 12 | 20.80 | 20.60 | 4.10 | 214 | 11.50 |
| 16 | 20.80 | 20.60 | ---- | 244 | 12.00 |
| 20 | 20.80 | 20.60 | ---- | 180 | 9.67 |
| 24 | 20.80 | 20.60 | ---- | 162 | 8.70 |
| 28 | 20.80 | 20.60 | ----- | 162 | 8.70 |
| 32 | 20.80 | 20.60 | ---- | 162 | 8.70 |

Table 45.

"A" open 31 deg. 71.5 deg. Fahr.
"B" open 4 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | 20.86 | 20.86 | 4.50 | 42 | 2.25 |
| 8 | 20.86 | 20.80 | 4.20 | 64 | 3.44 |
| 12 | 20.86 | 20.80 | ---- | 70 | 2.76 |
| 16 | 20.86 | 20.80 | ---- | 70 | 2.76 |
| 20 | 20.86 | 20.80 | ---- | 70 | 2.76 |
| 24 | 20.86 | 20.80 | ---- | 70 | 2.76 |
| 28 | 20.86 | 20.80 | ---- | 70 | 2.76 |
| 32 | 20.86 | 20.80 | ---- | 70 | 2.76 |

Table 46.

"A" open 27 deg. 71.5 deg. Fahr.
"B" open 36 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.77 | ---- | 144 | 2.38 |
| 8 | ----- | 20.65 | ---- | 121 | 6.54 |
| 12 | 20.72 | 20.45 | 4.40 | 210 | 11.35 |
| 16 | ----- | 19.75 | ---- | 355 | 19.20 |
| 20 | ----- | 18.70 | ---- | 527 | 28.50 |
| 24 | 20.33 | 17.33 | 3.50 | 685 | 37.05 |
| 28 | ----- | 16.65 | ---- | 805 | 43.50 |
| 32 | ----- | 16.65 | ---- | 765 | 41.35 |

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Table 47.

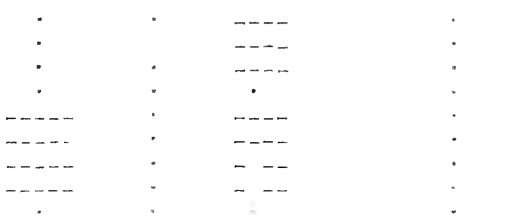
"A" open 27 deg. 71.5 deg. Fahr.
"B" open 32 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.79 | ---- | 45 | 2.41 |
| 8 | ----- | 20.66 | ---- | 120 | 6.49 |
| 12 | ----- | 20.40 | ---- | 214 | 11.50 |
| 16 | ----- | 19.33 | ---- | 357 | 19.15 |
| 20 | 20.50 | 18.84 | 3.80 | 519 | 27.90 |
| 24 | 20.50 | 18.54 | ---- | 610 | 32.70 |
| 28 | 20.50 | 18.54 | ---- | 559 | 30.00 |
| 32 | 20.50 | 18.54 | ---- | 540 | 29.00 |

Table 48.

"A" open 27 deg. 71.5 deg. Fahr.
"B" open 28 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.78 | ---- | 44 | 2.36 |
| 8 | ----- | 20.65 | ---- | 116 | 6.22 |
| 12 | ----- | 20.32 | ---- | 214 | 11.50 |
| 16 | ----- | 19.80 | ---- | 352 | 18.90 |
| 20 | 20.54 | 18.90 | 3.80 | 520 | 27.90 |
| 24 | 20.54 | 18.81 | ---- | 586 | 31.40 |
| 28 | 20.54 | 18.81 | ---- | 517 | 27.75 |
| 32 | 20.54 | 18.81 | ---- | 510 | 27.40 |



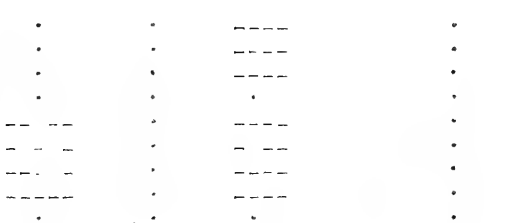


Table 49.

"A" open 27 deg. 71.5 deg. Fahr.
"B" open 24 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.79 | ---- | 45 | 2.41 |
| 8 | ----- | 20.67 | ---- | 118 | 6.34 |
| 12 | ----- | 20.43 | ---- | 227 | 12.20 |
| 16 | 20.70 | 19.80 | 4.20 | 360 | 19.30 |
| 20 | ----- | 19.15 | ---- | 499 | 26.80 |
| 24 | 20.60 | 19.07 | ---- | 538 | 28.90 |
| 28 | 20.60 | 19.10 | ---- | 462 | 24.80 |
| 32 | 20.60 | 19.20 | ---- | 462 | 24.80 |

Table 50.

"A" open 27 deg. 71.5 deg. Fahr.
"B" open 20 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.79 | ---- | 45 | 2.41 |
| 8 | ----- | 20.68 | ---- | 117 | 6.28 |
| 12 | 20.81 | 20.37 | 4.32 | 228 | 12.75 |
| 16 | ----- | 19.80 | ---- | 347 | 18.60 |
| 20 | ----- | 19.42 | ---- | 496 | 26.60 |
| 24 | ----- | 19.48 | ---- | 426 | 22.85 |
| 28 | 20.68 | 19.50 | ---- | 416 | 22.30 |
| 32 | 20.68 | 19.52 | ---- | 410 | 22.00 |

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Table 51.

"A" open 27 deg. 71.5 deg. Fahr.
"B" open 16 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.79 | ---- | 45 | 2.41 |
| 8 | ----- | 20.69 | ---- | 116 | 6.22 |
| 12 | 20.75 | 20.40 | 4.31 | 220 | 11.80 |
| 16 | ----- | 19.95 | ---- | 345 | 18.50 |
| 20 | ----- | 19.88 | ---- | 352 | 18.90 |
| 24 | 20.70 | 19.88 | ---- | 350 | 18.80 |
| 28 | ----- | 19.88 | ---- | 350 | 18.80 |
| 32 | 20.70 | 19.88 | ---- | 350 | 18.80 |

Table 52.

"A" open 27 deg. 71.5 deg. Fahr.
"B" open 12 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.80 | ---- | 44 | 2.38 |
| 8 | ----- | 20.70 | ---- | 116 | 6.20 |
| 12 | ----- | 20.40 | ---- | 222 | 11.90 |
| 16 | 20.78 | 20.22 | 3.50 | 348 | 18.70 |
| 20 | 20.78 | 20.22 | ---- | 279 | 14.95 |
| 24 | 20.78 | 20.22 | ----- | 264 | 14.15 |
| 28 | 20.78 | 20.22 | ---- | 260 | 13.95 |
| 32 | 20.78 | 20.22 | ---- | 260 | 13.95 |

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Table 53.

"A" open 27 deg. 71.5 deg. Fahf.
"B" open 8 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.81 | ---- | 44 | 2.38 |
| 8 | ----- | 20.6E | ---- | 115 | 6.17 |
| 12 | 20.80 | 20.51 | 3.80 | 209 | 11.200 |
| 16 | 20.80 | 20.51 | ---- | 209 | 11.20 |
| 20 | 20.80 | 20.51 | ---- | 162 | 8.70 |
| 24 | 20;80 | 20.51 | ---- | 162 | 8.70 |
| 28 | 20.80 | 20.51 | ---- | 162 | 8.70 |
| 32 | 20.80 | 20.51 | ---- | 162 | 8.70 |

Table 54.

"A" open 27 deg. 71.5 deg. Fahr.
"B" open 4 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.79 | ---- | 43 | 2.30 |
| 8 | 20.85 | 20.79 | 3.70 | 108 | 5.80 |
| 12 | 20.85 | 20.79 | ---- | 80 | 4.30 |
| 16 | 20.85 | 20.79 | ---- | 64 | 3.44 |
| 20 | 20.85 | 20.79 | ---- | 64 | 3.44 |
| 24 | 20.85 | 20.79 | ---- | 64 | 3.44 |
| 28 | 20.85 | 20.79 | ---- | 64 | 3.44 |
| 32 | 20.85 | 20.79 | ---- | 64 | 3.44 |

Table 55.

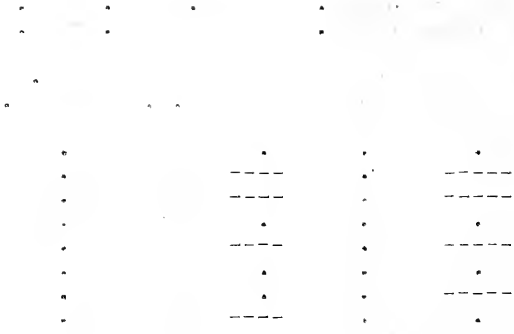
"A" open 23 deg. 71.5 deg. Fahr.
"B" open 36 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.75 | ---- | 45 | 2.41 |
| 8 | ----- | 20.51 | ---- | 122 | 6.60 |
| 12 | 20.70 | 20.15 | 4.30 | 215 | 11.60 |
| 16 | ----- | 19.20 | ---- | 350 | 18.90 |
| 20 | 20.53 | 17.50 | 3.90 | 524 | 28.30 |
| 24 | ----- | 15.35 | 3.45 | 688 | 37.15 |
| 28 | 20.30 | 15.15 | ---- | 726 | 39.20 |
| 32 | 20.30 | 15.15 | ---- | 680 | 36.70 |

Table 56.

"A" open 23 deg. 71.5 deg. Fahr.
"B" open 32 deg. 2 min. runs.

| Valve C | head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.79 | ---- | 45 | 2.40 |
| 8 | ----- | 20.60 | ---- | 115 | 6.17 |
| 12 | ----- | 20.15 | ---- | 211 | 11.30 |
| 16 | ----- | 19.21 | ---- | 356 | 19.10 |
| 20 | 20.60 | 18.32 | 3.32 | 496 | 26.60 |
| 24 | ----- | 18.35 | ---- | 468 | 25.10 |
| 28 | ----- | 18.35 | ---- | 461 | 24.20 |
| 32 | ----- | 18;35 | ---- | 446 | 23.90 |



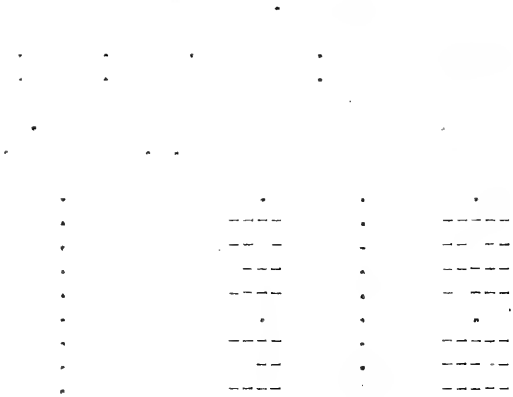


Table 57.

"A" open 23 deg. 71.5 deg. Fahr.
"B" open 28 deg. 2 min. runs.

| Valve | Head of fuel | | | | Lb. |
|---|---|---|---|---|---|
| C | L | F | H | C.C. | per hr. |
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.78 | ---- | 44 | 2.38 |
| 8 | 20.82 | 20.60 | 4.40 | 117 | 6.28 |
| 12 | ----- | 20.18 | ---- | 232 | 12,45 |
| 16 | 20.70 | 19.27 | 4.10 | 360 | 19.30 |
| 20 | ----- | 18.51 | ---- | 496 | 26.60 |
| 24 | 20.63 | 18.48 | ---- | 454 | 24.40 |
| 28 | ----- | 18.48 | ---- | 454 | 24.40 |
| 32 | 20.63 | 18.48 | ---- | 454 | 24.40 |

Table 58.

"A" open 23 deg. 71.5 deg. Fahr.
"B" open 24 deg. 2 min. runs.

| Valve | Head of fuel | | | | Lb. |
|---|---|---|---|---|---|
| Cq | L | F | H | C.C. | per hr. |
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.78 | ---- | 44 | 2.38 |
| 8 | ----- | 20.61 | 4.40 | 118 | 6.34 |
| 12 | 20.75 | 20.15 | ---- | 214 | 11.50 |
| 16 | ----- | 19.30 | 4.10 | 360 | 19.30 |
| 20 | 20.65 | 18.85 | ---- | 482 | 25.85 |
| 24 | ----- | 18.85 | ---- | 422 | 22.60 |
| 28 | ----- | 18.85 | ---- | 398 | 21.35 |
| 32 | ----- | 18.85 | ---- | 400 | 21.45 |

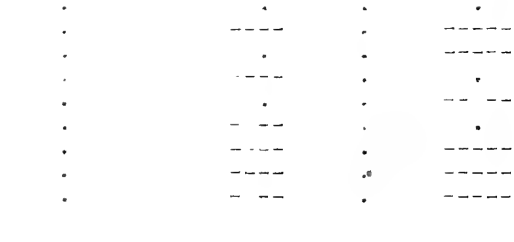


Table 59.

"A" open 23 deg. 71.5 deg. Fahr.
"B" open 20 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.79 | ---- | 44 | 2.38 |
| 8 | ----- | 20.57 | 4.40 | 118 | 6.34 |
| 12 | 20.80 | 20.20 | ---- | 222 | 11.90 |
| 16 | ----- | 19.37 | 4.10 | 354 | 19.00 |
| 20 | 20.70 | 19.20 | ---- | 440 | 23.60 |
| 24 | ----- | 19.20 | ---- | 362 | 19.40 |
| 28 | ----- | 19.20 | ---- | 362 | 19.40 |
| 32 | 20.70 | 19.20 | ---- | 362 | 19.40 |

Table 60

"A" open 23 deg. 71.5 deg. Fahr.
"B" open 16 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.80 | ---- | 44 | 2.38 |
| 8 | ----- | 20.59 | ---- | 117 | 6.28 |
| 12 | ----- | 20.12 | ---- | 214 | 11.50 |
| 16 | 20.73 | 19.60 | 3.80 | 352 | 18,90 |
| 20 | 20.73 | 19.51 | ---- | 360 | 19.30 |
| 24 | 20.73 | 19.51 | ---- | 320 | 17.15 |
| 28 | 20.73 | 19.51 | ---- | 320 | 17.15 |
| 32 | 20.73 | 19.51 | ---- | 320 | 17.15 |

Table 61.

"A" open 23 deg. 71.5 deg. Fahr.
"B" open 12 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.78 | ----- | 44 | 2.38 |
| 8 | ----- | 20.58 | ---- | 118 | 6.33 |
| 12 | 20.80 | 20.10 | 4.24 | 215 | 11.60 |
| 16 | 20.78 | 20.00 | ---- | 320 | 17.15 |
| 20 | 20.78 | 20.00 | ---- | 252 | 13.50 |
| 24 | 20.78 | 20.00 | ---- | 252 | 13.50 |
| 28 | 20.78 | 20.00 | ---- | 252 | 13.50 |
| 32 | 20.78 | 20.00 | ---- | 252 | 13.50 |

Table 62.

"A" open 23 deg. 71.5 deg. Fahr.
"B" open 8 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.600 | 0 | 0.00 |
| 4 | ----- | 20.80 | ---- | 45 | 2.41 |
| 8 | 20.80 | 20.58 | 4.40 | 118 | 6.33 |
| 12 | 20.78 | 20.40 | ---- | 222 | 11.90 |
| 16 | 20.78 | 20.40 | ---- | 189 | 10.15 |
| 20 | 20.78 | 20.40 | ---- | 158 | 8.49 |
| 24 | 20.78 | 20.40 | ---- | 158 | 8.49 |
| 28 | 20.78 | 20.40 | ---- | 158 | 8.49 |
| 32 | 20.78 | 20.40 | ---- | 158 | 8.49 |

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Table 63.

"A" open 23 deg, 71.5 deg. Fahr.
"B" open 4 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 2.25 |
| 4 | ----- | 20.78 | ---- | 42 | 6.01 |
| 8 | 20.83 | 20.78 | 3.65 | 112 | 3.52 |
| 12 | 20.83 | 20.78 | ---- | 66 | 3.33 |
| 16 | 20.83 | 20.78 | ---- | 62 | 3.33 |
| 20 | 20.83 | 20.78 | ---- | 62 | 3.33 |
| 24 | 20.83 | 20.78 | ---- | 62 | 3.33 |
| 28 | 20.83 | 20.78 | ---- | 62 | 3.33 |
| 32 | 20.83 | 20.78 | ---- | 62 | 3.33 |

Table 64.

"A" open 19 deg. 71.5 deg. Fahr.
"B" open 36 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.78 | ----- | 45 | 2.43 |
| 8 | ----- | 20.42 | ---- | 120 | 6.49 |
| 12 | 20.80 | 19.65 | 4.30 | 218 | 11.75 |
| 16 | ----- | 18.00 | 3.90 | 355 | 19.20 |
| 20 | 20.40 | 14.80 | 3.20 | 514 | 27.70 |
| 24 | 20.40 | 12.00 | ---- | 660 | 35.60 |
| 28 | 20.40 | 12.20 | ---- | 645 | 34.85 |
| 32 | 20.40 | 12.50 | ---- | 620 | 33.50 |

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Table 65.

"A" open 19 deg. 71.5 deg. Fahr.
"B" open 32 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.78 | ----- | 44 | 2.38 |
| 8 | 20.80 | 20.39 | 4.40 | 118 | 6.33 |
| 12 | ----- | 19.62 | ---- | 214 | 11.50 |
| 16 | 20.70 | 18.20 | 4.10 | 368 | 19.75 |
| 20 | 20.68 | 17.70 | ---- | 426 | 22.80 |
| 24 | 20.68 | 17.70 | ---- | 378 | 20.15 |
| 28 | 20.68 | 17.70 | ---- | 378 | 20.15 |
| 32 | 20.68 | 17.70 | ---- | 378 | 20.15 |

Table 66.

"A" open 19 deg. 71.5 deg. Fahr.
"B" open 28 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.77 | ---- | 43 | 2.31 |
| 8 | ----- | 20.40 | 4.40 | 118 | 6.33 |
| 12 | 20.75 | 19.58 | ---- | 214 | 11.50 |
| 16 | 20.70 | 18.00 | 4.05 | 360 | 19.30 |
| 20 | ----- | 17.56 | ---- | 450 | 24.15 |
| 24 | 20.63 | 17.56 | ---- | 386 | 20.70 |
| 28 | 20.63 | 17.56 | ---- | 386 | 20.70 |
| 32 | 20.63 | 17.56 | ---- | 386 | 20.70 |

Table 67.

"A" open 19 deg. 71.5 deg. Fahr.
"B" open 24 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.78 | ---- | 44 | 2.38 |
| 8 | ----- | 20.38 | ---- | 119 | 6.39 |
| 12 | 20.65 | 19.60 | 4.30 | 214 | 11.50 |
| 16 | ----- | 18.03 | ---- | 358 | 19.20 |
| 20 | 20.67 | 17.65 | ---- | 435 | 23.30 |
| 24 | 20.67 | 17.65 | ---- | 378 | 20.30 |
| 28 | 20.67 | 17.65 | ---- | 378 | 20.30 |
| 32 | 20.67 | 17,65 | ---- | 378 | 20.30 |

Table 68.

"A" open 19 deg. 71.5 deg. Fahr.
"B" open 20 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.77 | ---- | 44 | 2.38 |
| 8 | ----- | 20.39 | ---- | 119 | 6.39 |
| 12 | ----- | 19.60 | ---- | 230 | 12.28 |
| 16 | 20.70 | 18.20 | 4.00 | 350 | 18.90 |
| 20 | 20.68 | 18.00 | ---- | 412 | 22.10 |
| 24 | 20.68 | 18.00 | ---- | 346 | 18.55 |
| 28 | 20.68 | 18.00 | ---- | 346 | 18.55 |
| 32 | 20.68 | 18.00 | ---- | 346 | 18.55 |

Table 69.

"A" open 19 deg. 71.5 deg. Fahr.
"B" open 16 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.78 | ----- | 43 | 2.31 |
| 8 | ----- | 20.40 | ---- | 118 | 6.33 |
| 12 | 20.80 | 19.64 | 4.35 | 216 | 11.60 |
| 16 | ----- | 18.65 | ---- | 346 | 18.55 |
| 20 | 20.72 | 18.54 | ---- | 355 | 19.05 |
| 24 | ----- | 18.54 | ---- | 304 | 16.30 |
| 28 | 20.70 | 18.60 | ---- | 302 | 16.20 |
| 32 | 20.70 | 18.60 | ---- | 302 | 16.20 |

Table 70.

"A" open 19 deg. 74 deg. Fahr.
"B" open 12 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.77 | ---- | 45 | 2.40 |
| 8 | ----- | 20.40 | ---- | 115 | 6.15 |
| 12 | 20.72 | 19.52 | 4.22 | 226 | 12.05 |
| 16 | ----- | 19.29 | ---- | 329 | 17.60 |
| 20 | 20.72 | 19.29 | ---- | 258 | 13.80 |
| 24 | 20.72 | 19.29 | ---- | 258 | 13.80 |
| 28 | 20.72 | 19.29 | ---- | 258 | 13.80 |
| 32 | 20.72 | 19.29 | ---- | 258 | 13.80 |

Table 71.

"A" open 19 deg. 74 deg. Fahr.
"B" open 8 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.77 | ---- | 44 | 2.35 |
| 8 | 20.80 | 20.40 | 4.37 | 117 | 6.25 |
| 12 | 20.78 | 20.17 | ---- | 217 | 11.60 |
| 16 | 20.78 | 20.17 | ---- | 181 | 9.68 |
| 20 | 20.78 | 20.17 | ---- | 158 | 8.45 |
| 24 | 20.78 | 20;17 | ---- | 146 | 7.80 |
| 28 | 20.78 | 20.17 | ---- | 146 | 7.80 |
| 32 | 20.78 | 20.17 | ---- | 146 | 7.80 |

Table 72.

"A" open 19 deg. 74 deg. Fahr.
"B" open 4 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.79 | ---- | 41 | 2.19 |
| 8 | 20.82 | 20.70 | ---- | 102 | 5.45 |
| 12 | 20.82 | 20.70 | ---- | 65 | 3.47 |
| 16 | 20.82 | 20.70 | ---- | 65 | 3.47 |
| 20 | 20.82 | 20.70 | ---- | 65 | 3.47 |
| 24 | 20.82 | 20.70 | ---- | 65 | 3.47 |
| 28 | 20.82 | 20.70 | ---- | 65 | 3.47 |
| 32 | 20.82 | 20.70 | ---- | 65 | 3.47 |

Table 73.

"A" open 15 deg. 71.5 deg. Fahr.
"B" open 36 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.73 | ---- | 44 | 2.38 |
| 8 | ----- | 19.42 | ---- | 121 | 6.54 |
| 12 | 20.80 | 18.10 | 4.30 | 218 | 11.75 |
| 16 | 20.70 | 14.60 | 4.13 | 350 | 18.90 |
| 20 | 20.60 | 10.10 | ---- | 493 | 26.60 |
| 24 | 20.60 | 10.10 | ---- | 475 | 25.65 |
| 28 | 20.60 | 10.40 | ---- | 460 | 24.85 |
| 32 | 20.60 | 10.60 | ---- | 450 | 24.30 |

Table 74.

"A" open 15 deg. 74 deg. Fahr.
"B" open 32 deg. 2 min. runs.

| Valve C | Hesd of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.70 | ---- | 44 | 2.35 |
| 8 | 20.79 | 19.95 | 4.39 | 116 | 6.20 |
| 12 | ----- | 18.10 | ---- | 222 | 11.85 |
| 16 | 20.70 | 15.20 | ----- | 346 | 18.65 |
| 20 | 20.70 | 15.10 | ---- | 365 | 19.50 |
| 24 | 20.70 | 15.35 | ---- | 340 | 18.15 |
| 28 | 20.70 | 15.50 | ---- | 336 | 17.95 |
| 32 | 20.70 | 15.60 | ---- | 333 | 17.80 |

Table 75.

"A" open 15 deg. 74 deg. Fahr.
"B" open 28 deg. 2 min, runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.69 | ---- | 44 | 2.35 |
| 8 | ----- | 20.14 | ---- | 116 | 6.20 |
| 12 | 20.70 | 18.33 | 4.39 | 220 | 11.75 |
| 16 | 20.70 | 16.20 | 3.80 | 338 | 18.05 |
| 20 | 20.70 | 16.20 | ---- | 336 | 17.95 |
| 24 | 20.70 | 16.30 | ---- | 316 | 16.90 |
| 28 | 20.70 | 16.35 | ---- | 308 | 16.45 |
| 32 | 20.70 | 16.40 | ---- | 298 | 15.90 |

Table 76.

"A" open 15 deg. 74 deg. Fahr.
"B" open 24 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.70 | ---- | 43 | 2.30 |
| 8 | ----- | 20.00 | ---- | 117 | 6.25 |
| 12 | 20.70 | 18.50 | 4.30 | 214 | 11.45 |
| 16 | 20.70 | 16.70 | ---- | 346 | 18.50 |
| 20 | 20.70 | 16.60 | ---- | 327 | 17.45 |
| 24 | 20.70 | 16.60 | ---- | 294 | 15.70 |
| 28 | 20.70 | 16.63 | ---- | 294 | 15.70 |
| 32 | 20.70 | 16.67 | ---- | 294 | 15.70 |

Table 77.

"A" open 15 deg. 74 deg. Fahr.
"B" open 20 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.68 | ---- | 44 | 2.35 |
| 8 | ----- | 19.97 | ---- | 114 | 6.10 |
| 12 | 20.73 | 18.00 | 4.30 | 216 | 11.55 |
| 16 | 20.73 | 17.22 | ---- | 333 | 17.80 |
| 20 | 20.73 | 17.22 | ---- | 292 | 15.60 |
| 24 | 20.73 | 17.26 | ---- | 268 | 14.30 |
| 28 | 20.73 | 17.29 | ---- | 268 | 14.30 |
| 32 | 20.73 | 17.32 | ---- | 268 | 14.30 |

Table 78.

"A" open 15 deg. 74 deg. Fahr.
"B" open 16 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.69 | ---- | 44 | 2.35 |
| 8 | ----- | 19.92 | ---- | 116 | 6.20 |
| 12 | ----- | 18.30 | ---- | 224 | 11.95 |
| 16 | 20.70 | 17.72 | 3.35 | 329 | 17.60 |
| 20 | 20.70 | 17.70 | ---- | 254 | 13.55 |
| 24 | 20.70 | 17.75 | ---- | 250 | 13.35 |
| 28 | 20.70 | 17.80 | ---- | 250 | 13.35 |
| 32 | 20.70 | 17.84 | ---- | 250 | 13.35 |

Table 79.

"A" open 15 deg. 74 deg. Fahr.
"B" open 12 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.69 | 0 | 0.00 |
| 4 | ----- | 20.68 | ----- | 44 | 2.35 |
| 8 | ----- | 20.00 | ---- | 117 | 6.25 |
| 12 | ----- | 18.65 | ---- | 220 | 11.75 |
| 16 | 20.70 | 18.50 | ---- | 274 | 14.65 |
| 20 | 20.70 | 18.55 | ---- | 212 | 11.30 |
| 24 | 20.70 | 18.58 | ---- | 208 | 11.10 |
| 28 | 20.70 | 18.60 | ---- | 195 | 10.40 |
| 32 | 20.70 | 18.65 | ---- | 195 | 10.40 |

Table 80.

"A" open 15 deg. 74 deg. Fahr.
"B" open 8 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.69 | ---- | 44 | 2.35 |
| 8 | ----- | 19.98 | ---- | 117 | 6.25 |
| 12 | 20.77 | 19.60 | 3.80 | 206 | 11.00 |
| 16 | 20.77 | 19.60 | ---- | 160 | 8.55 |
| 20 | 20.77 | 19.60 | ---- | 142 | 7.59 |
| 24 | 20.77 | 19.60 | ---- | 142 | 7.59 |
| 28 | 20.77 | 19.60 | ---- | 142 | 7.59 |
| 32 | 20.77 | 19.60 | ---- | 142 | 7.59 |

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Table 81.

"A" open 15 deg. 74 deg. Fahr.
"B" open 4 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | 20.82 | 20.60 | 4.20 | 42 | 2.24 |
| 8 | 20.82 | 20.60 | ---- | 110 | 5.87 |
| 12 | 20.82 | 20.60 | ---- | 76 | 4.06 |
| 16 | 20.82 | 20.602 | ---- | 62 | 3.31 |
| 20 | 20.82 | 20.60 | ---- | 62 | 3.31 |
| 24 | 20.82 | 20.60 | ---- | 62 | 3.31 |
| 28 | 20.82 | 20.60 | ---- | 62 | 3.31 |
| 32 | 20.82 | 20.60 | ---- | 62 | 3.31 |

Table 82.

"A" open 11 deg. 74 deg. Fahr.
"B" open 36 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.48 | ---- | 44 | 2.38 |
| 8 | 20.80 | 18.66 | 4.40 | 121 | 6.50 |
| 12 | 20.75 | 14.50 | ---- | 216 | 11.64 |
| 16 | 20.75 | 8.10 | ---- | 337 | 18.20 |
| 20 | 20.75 | 7.90 | ---- | 325 | 17.55 |
| 24 | 20.75 | 8.10 | ---- | 309 | 16.70 |
| 28 | 20.75 | 8.20 | ---- | 304 | 16.45 |
| 32 | 20.75 | 8.30 | ----- | 302 | 16.30 |

Table 83.

"A" open 11 deg. 74 deg. Fahr.
"B" open 32 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.48 | ---- | 44 | 2.35 |
| 8 | 20.78 | 18.63 | 4.40 | 122 | 6.52 |
| 12 | ----- | 14.00 | ---- | 216 | 11.55 |
| 16 | 20.70 | 14.00 | ---- | 252 | 13.45 |
| 20 | 20.70 | 14.00 | ---- | 218 | 11.65 |
| 24 | 20.70 | 14.00 | ---- | 218 | 11.65 |
| 28 | 20.70 | 14.00 | ---- | 218 | 11.65 |
| 32 | 20.70 | 14.00 | ---- | 218 | 11.65 |

Table 84.

"A" open 11 deg. 74 deg. Fahr.
"B" open 28 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.49 | ---- | 44 | 2.35 |
| 8 | 20.78 | 18.63 | 4.40 | 115 | 6.15 |
| 12 | ----- | 14.60 | ---- | 210 | 11.20 |
| 16 | 20.70 | 14.25 | ---- | 248 | 13.25 |
| 20 | 20.70 | 14.30 | ---- | 212 | 11.30 |
| 24 | 20.70 | 14.40 | ---- | 208 | 11.10 |
| 28 | 20.70 | 14.50 | ---- | 208 | 11.10 |
| 32 | 20.70 | 14.50 | ---- | 208 | 11.10 |

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Table 85.

"A" open 11 deg. 74 deg. Fahr.
"B" open 24 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.50 | ---- | 44 | 2.35 |
| 8 | ----- | 18.65 | ---- | 115 | 6.15 |
| 12 | ----- | 14.85 | ---- | 213 | 11.40 |
| 16 | 20.72 | 14.30 | ---- | 290 | 15.50 |
| 20 | 20.72 | 14.30 | ---- | 223 | 11.90 |
| 24 | 20.72 | 14.40 | ---- | 211 | 11.25 |
| 28 | 20.72 | 14.50 | ---- | 209 | 11.15 |
| 32 | 20.72 | 14.50 | ---- | 207 | 11.05 |

Table 86.

"A" open 11 deg. 74 deg. Fahf.
"B" open 20 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.49 | ---- | 43 | 2.30 |
| 8 | 20.78 | 18.60 | 4.40 | 115 | 6.15 |
| 12 | ----- | 15.03 | ---- | 212 | 11.30 |
| 16 | ----- | 14.71 | ---- | 279 | 14.90 |
| 20 | ----- | 14.78 | ---- | 204 | 10.90 |
| 24 | 20.70 | 14.78 | ---- | 204 | 10.90 |
| 28 | 20.70 | 14.78 | ---- | 204 | 10.90 |
| 32 | 20.70 | 14.78 | ---- | 204 | 10.90 |

Table 87.

"A" open 11 deg. 74 deg. Fahr.
"B" open 16 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ------ | 20.48 | ---- | 44 | 2.35 |
| 8 | ----- | 18.65 | ---- | 116 | 6.20 |
| 12 | ----- | 15.40 | ---- | 207 | 11.05 |
| 16 | 20.70 | 15.20 | ---- | 260 | 13.90 |
| 20 | 20.70 | 15.20 | ---- | 196 | 10.45 |
| 24 | 20.70 | 15.25 | ---- | 192 | 10.25 |
| 28 | 20.70 | 15.28 | ---- | 192 | 10.25 |
| 32 | 20.70 | 15.33 | ---- | 192 | 10.25 |

Table 88

"A" open 11 deg. 74 deg. Fahr.
"B" open 12 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.49 | ---- | 43 | 2.30 |
| 8 | 20.78 | 18.45 | ---- | 116 | 6.20 |
| 12 | 20.78 | 16.40 | ---- | 228 | 12.20 |
| 16 | 20.78 | 16.30 | ---- | 220 | 11.75 |
| 20 | 20.78 | 16.35 | ---- | 177 | 9.46 |
| 24 | 20.78 | 16.40 | ---- | 173 | 9.25 |
| 28 | 20.78 | 16.40 | ---- | 170 | 9.09 |
| 32 | 20.78 | 16.40 | ---- | 170 | 9.09 |

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Table 89.

"A" open 11 deg. 74 deg. Fahr.
"B" open 8 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.50 | ---- | 44 | 2.35 |
| 8 | ----- | 18.66 | ---- | 114 | 10.70 |
| 12 | 20.78 | 18.15 | ---- | 200 | 7.48 |
| 16 | 20.78 | 18.12 | ---- | 140 | 6.95 |
| 20 | 20.78 | 18.12 | ---- | 130 | 6.95 |
| 24 | 20.78 | 18.12 | ---- | 130 | 6.95 |
| 28 | 20.78 | 18.12 | ---- | 130 | 6.95 |
| 32 | 20.78 | 18.12 | ---- | 130 | 6.95 |

Table 90.

"A" open 11 deg. 74 deg. Fahr.
"B" open 4 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 4 | ----- | 20.25 | ---- | 41 | 2.19 |
| 8 | 20.82 | 20.25 | ---- | 104 | 5.56 |
| 12 | 20.80 | 20.25 | ---- | 64 | 3.42 |
| 16 | 20.80 | 20.25 | ---- | 60 | 3.21 |
| 20 | 20.80 | 20.25 | ---- | 60 | 3.21 |
| 24 | 20.80 | 20.25 | ---- | 60 | 3.21 |
| 28 | 20.80 | 20.25 | ---- | 60 | 3.21 |
| 32 | 20.80 | 20.25 | ---- | 60 | 3.21 |

Table 91.

"A" open 7 deg. 71.5 deg. Fahr.
"B" open 36 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.000 |
| 2 | ----- | 20.60 | ---- | 19 | 1.020 |
| 4 | ----- | 19.40 | ---- | 44 | 2.380 |
| 6 | ----- | 17.30 | ---- | 76 | 4.110 |
| 8 | 20.80 | 12,30 | 4.35 | 121 | 6.540 |

Table 92.

"A" open 7 deg. 66 deg. Fahr.
"B" open 32deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.000 |
| 2 | ----- | 20.59 | ---- | 18 | 0.970 |
| 4 | ----- | 19.46 | ---- | 44 | 2.370 |
| 6 | ----- | 17.25 | ---- | 77 | 4.150 |
| 8 | 20.78 | 12.30 | 4.25 | 122 | 6.570 |

Table 93.

"A" open 7 deg. 66 deg. Fahr.
"B" open 28 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 2 | 20.85 | 20.58 | 4.50 | 19 | 1.02 |
| 4 | *----- | 19.45 | ---- | 44 | 2.37 |
| 6 | ----- | 17.28 | ---- | 76 | 4.10 |
| 8 | 20.80 | 12.30 | 4.35 | 123 | 6.53 |

Table 94.

"A" open 7 deg. 66 deg. Fahr.
"B" open 24 deg. F 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 2 | ----- | 20.58 | ---- | 19 | 1.02 |
| 4 | ----- | 19.43 | ---- | 44 | 2.37 |
| 6 | ----- | 17.28 | ---- | 76 | 4.10 |
| 8 | ----- | 12.28 | ---- | 123 | 6.53 |

Table 95.

"A" open 7 deg. 66 deg. Fahr.
"B" open 20 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 2 | ----- | 20.57 | ---- | 18 | 0.97 |
| 4 | ----- | 19.44 | ----- | 44 | 2.37 |
| 6 | ----- | 17.30 | ---- | 77 | 4.15 |
| 8 | ----- | 12.30 | ---- | 122 | 6.57 |

Table 96.

"A" open 7 deg. 66 deg. Fahr.
"B" open 16 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 2 | ----- | 20.55 | ---- | 19 | 1.02 |
| 4 | ----- | 19.46 | ---- | 44 | 2.37 |
| 6 | ----- | 17.30 | ---- | 77 | 4.15 |
| 8 | 20.80 | 12.30 | 4.35 | 123 | 6.55 |

Table 97.

"A" open 7 deg. 66 deg. Fahr.
"B" open 12 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 2 | ----- | 20.55 | ---- | 19 | 1.02 |
| 4 | ----- | 19.50 | ---- | 43 | 2.31 |
| 6 | ----- | 17.30 | ---- | 77 | 4.15 |
| 8 | 20.80 | 12.30 | 4.35 | 122 | 6.57 |

Table 98

"A" open 7 deg. 66 deg. Fahr.
"B" open 8 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | LB. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 2 | ----- | 20.50 | ---- | 19 | 1.02 |
| 4 | ----- | 19.47 | ---- | 44 | 2.37 |
| 6 | ----- | 16.75 | ---- | 78 | 4.20 |
| 8 | 20.80 | 12.30 | 4.35 | 124 | 6.68 |
| 10 | 20.75 | 10.30 | ---- | 166 | 8.95 |
| 14 | 20.75 | 10.30 | ---- | 142 | 7.65 |
| 18 | 20.75 | 10.30 | ---- | 128 | 6.90 |
| 26 | 20.75 | 10.30 | ----- | 128 | 6.90 |
| 32 | 20.75 | 10.30 | ---- | 128 | 6.90 |

Table 99.

"A" open 7 deg. 66 deg. Fahr.
"B" open 4 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.00 |
| 2 | ----- | 20.75 | ---- | 19 | 1.02 |
| 4 | 20.85 | 19.20 | 4.40 | 44 | 2.37 |
| 6 | 20.80 | 18.10 | ---- | 78 | 4.20 |
| 8 | 20.80 | 17.90 | ---- | 113 | 6.08 |
| 10 | 20.80 | 17.90 | ---- | 83 | 4.47 |
| 12 | 20.80 | 17.90 | ---- | 74 | 3.98 |
| 18 | 20.80 | 17.90 | ---- | 74 | 3.98 |
| 24 | 20.80 | 17.90 | ---- | 74 | 3.98 |
| 32 | 20.80 | 17.90 | ---- | 74 | 3.98 |

Table 100.

"A" open 3 deg. 66 deg. Fahr.
"B" open 36 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0.00 | 0.000 |
| 1 | ----- | 20.84 | ---- | 6 | 0.324 |
| 2 | ----- | 19.92 | ---- | 13 | 0.701 |
| 3 | ----- | 13.60 | ---- | 31 | 1.670 |

Table 101.

"A" open 3 deg. 66 deg. Fahr.
"B" open 32 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0.0 | 0.000 |
| 1 | ----- | 20.84 | ---- | 6.0 | 0.324 |
| 2 | ----- | 19.92 | ----- | 13.0 | 0.701 |
| 3 | ----- | 13.60 | ---- | 31.5 | 1.695 |

Table 102.

"A" open 3 deg. 66 deg. Fahr.
"B" open 28 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0.0 | 0.000 |
| 1 | ----- | 20.84 | ---- | 5.5 | 0.296 |
| 2 | ----- | 19.92 | ---- | 13.0 | 0.701 |
| 3 | ----- | 13.59 | ---- | 31.0 | 1.670 |

Table 103.

"A" open 3 deg. 66 deg. Fahr.
"B" open 24 deg... 2 min. runs.

| Valve C | Head of feul L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0.0 | 0.000 |
| 1 | ----- | 20.82 | ---- | 6.0 | 0.324 |
| 2 | ----- | 19.92 | ---- | 13.0 | 0.701 |
| 3 | ----- | 13.60 | ---- | 30.5 | 1.645 |

Table 104.

"A" open 3 deg. 66 deg. Fahr.
"B" open 20 deg. 2 min. runs.

| Valve | Head of fuel | | | | Lb. |
|---|---|---|---|---|---|
| C | L | F | H | C.C. | per hr. |
| 0 | 20.90 | 20.90 | 4.60 | 0.0 | 0.000 |
| 1 | ----- | 20.85 | ---- | 5.5 | 0.296 |
| 2 | ----- | 19.83 | ---- | 12.5 | 0.674 |
| 3 | ----- | 13.61 | ---- | 31.0 | 1.670 |

Table 105.

"A" open 3 deg. 66 deg. Fahr.
"B" open 16 deg. 2 min. runs.

| Valve | Head of fuel | | | | Lb. |
|---|---|---|---|---|---|
| C | L | F | H | C.C. | per hr. |
| 0 | 20.90 | 20.90 | 4.60 | 0.0 | 0.000 |
| 1 | ----- | 20.84 | ---- | 6.0 | 0.324 |
| 2 | ----- | 19.94 | ---- | 13.0 | 0.701 |
| 3 | ----- | 13.60 | ---- | 31.0 | 1.670 |

Table 106.

"A" open 3 deg. 66 deg. Fahr.
"B" open 12 deg. 2 min. runs.

| Valve | Head of fuel | | | | Lb. |
|---|---|---|---|---|---|
| C | L | F | H | C.C. | per hr. |
| 0 | 20.90 | 20.90 | 4.60 | 0.0 | 0.000 |
| 1 | ----- | 20.84 | ---- | 6.0 | 0.324 |
| 2 | ----- | 19.92 | ---- | 13.0 | 0.701 |
| 3 | ----- | 13.60 | ---- | 31.0 | 1.670 |

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Table 107.

"A" open 3 deg. 66 deg. Fahr.
"B" open 8 deg. 2 min. runs.

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0.0 | 0.000 |
| 1 | ----- | 20.85 | ---- | 5.5 | 0.296 |
| 2 | ----- | 19.91 | ---- | 13.5 | 0.728 |
| 3 | ----- | 13.58 | ---- | 30.5 | 1.645 |

Table 108.

"A" open 3 deg. 66 deg. Fahr.
"B" open 4 deg. 2 min. runs

| Valve C | Head of fuel L | F | H | C.C. | Lb. per hr. |
|---|---|---|---|---|---|
| 0 | 20.90 | 20.90 | 4.60 | 0 | 0.000 |
| 1 | ----- | 20.83 | ---- | 6 | 0.324 |
| 2 | ----- | 20.62 | ---- | 13 | 0.701 |
| 3 | ----- | 20.35 | ---- | 30 | 1.615 |
| 4 | ----- | 19.00 | ----- | 34 | 1.830 |
| 5 | ----- | 12.00 | ---- | 40 | 2.160 |
| 6 | ----- | 8.10 | ---- | 42 | 2.260 |
| 8 | ----- | 8.10 | ---- | 42 | 2.260 |
| 16 | ----- | 8.10 | ---- | 42 | 2.260 |
| 32 | ----- | 8.10 | ---- | 42 | 2.260 |

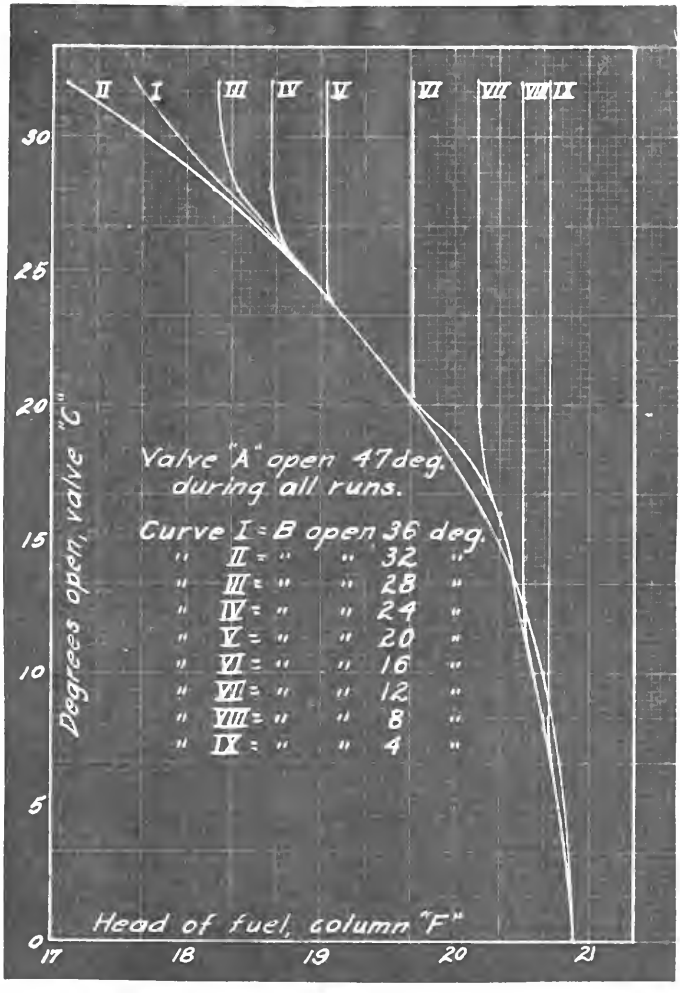

II
I
III
IV
V
VI
VII
VIII
IX
30
25
20
15
10
5
0
17
18
19
20
21
Degrees open, valve "C"
Head of fuel, column "F"
Valve "A" open 47deg.
during all runs.
Curve I = B open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "

Fig. 1.

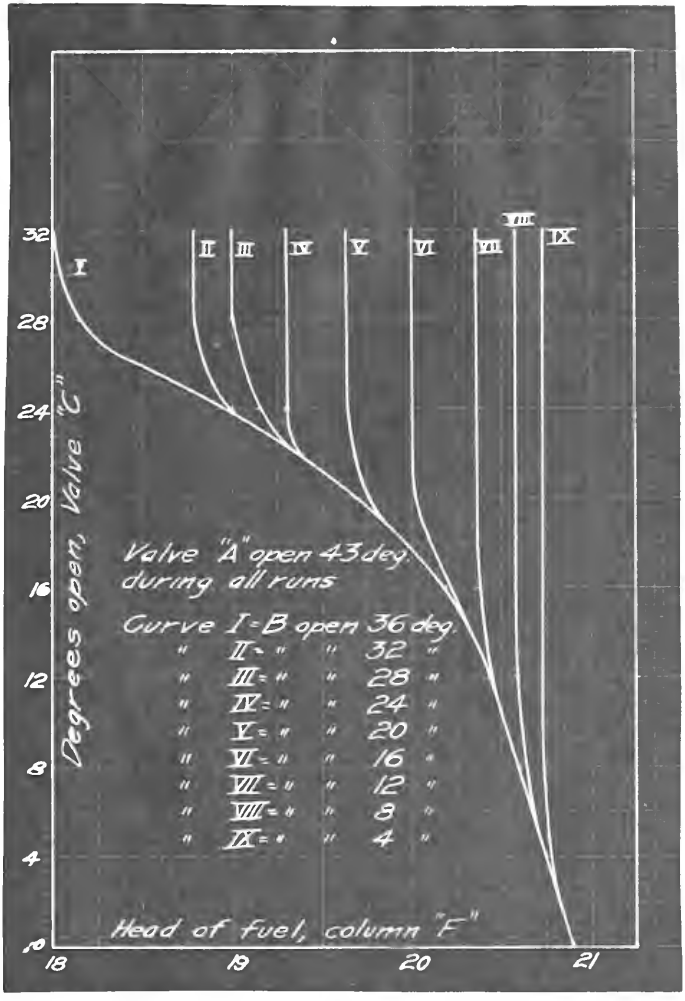

Degrees open, Valve "C"
32
28
24
20
16
12
8
4
0
18
19
20
21
I
II
III
IV
V
VI
VII
VIII
IX
Valve "A" open 43 deg.
during all runs
Curve I = B open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
Head of fuel, column "F"

**Fig. 2.**

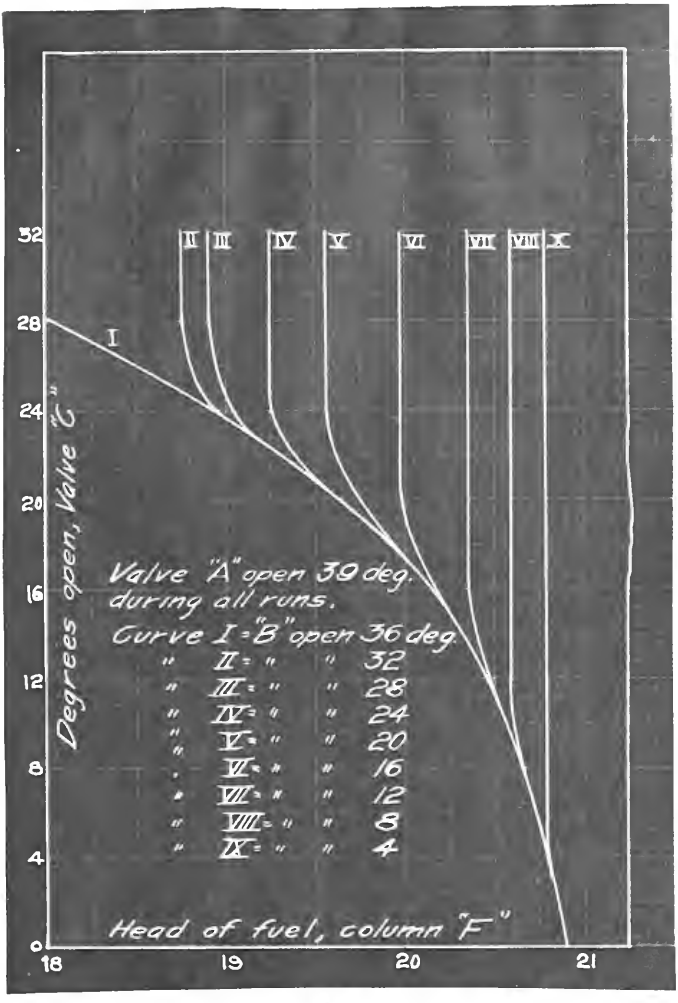

Degrees open, Valve "C"
Head of fuel, column "F"
Valve "A" open 39 deg.
during all runs.
Curve I = "B" open 36 deg.
" II = " " 32
" III = " " 28
" IV = " " 24
" V = " " 20
" VI = " " 16
" VII = " " 12
" VIII = " " 8
" IX = " " 4
I
II
III
IV
V
VI
VII
VIII
IX
0
4
8
12
16
20
24
28
32
18
19
20
21

Fig. 3.

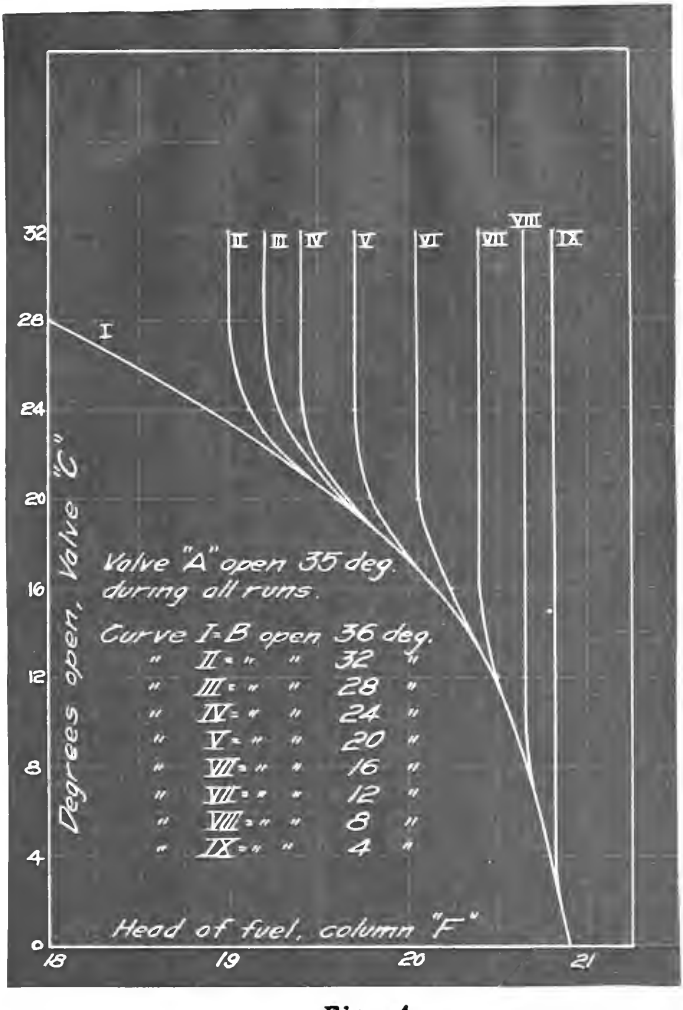

Degrees open, Valve "C"
Head of fuel, column "F"
Valve "A" open 35 deg. during all runs.
Curve I = B open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
I
II
III
IV
V
VI
VII
VIII
IX
0
4
8
12
16
20
24
28
32
18
19
20
21

Fig. 4.

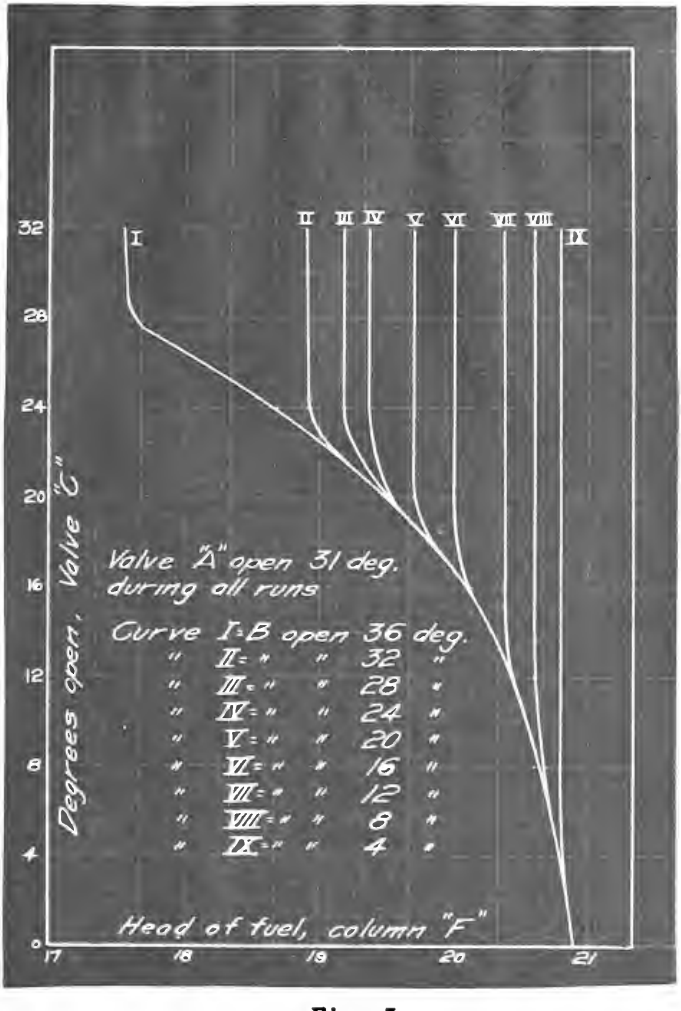

Degrees open, Valve "C"
Head of fuel, column "F"
Valve "A" open 31 deg.
during all runs
Curve I=B open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
I
II
III
IV
V
VI
VII
VIII
IX
0
4
8
12
16
20
24
28
32
17
18
19
20
21

Fig. 5.

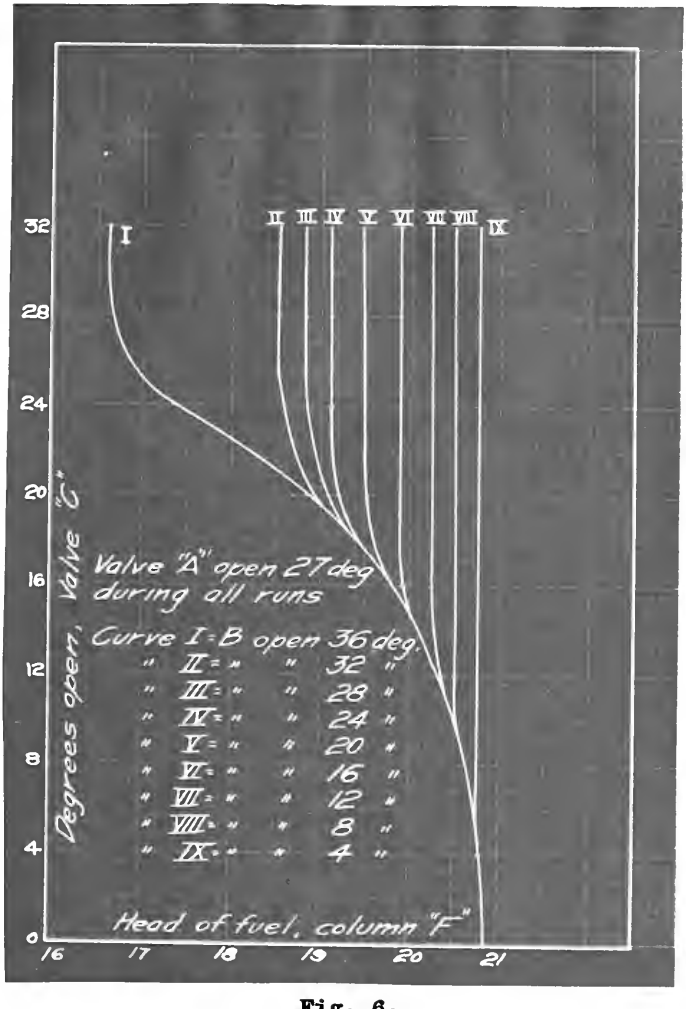

Degrees open, Valve "C"
32
28
24
20
16
12
8
4
0
16
17
18
19
20
21
I
II
III
IV
V
VI
VII
VIII
IX
Valve "A" open 27 deg
during all runs
Curve I = B open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
Head of fuel, column "F"

**Fig. 6.**

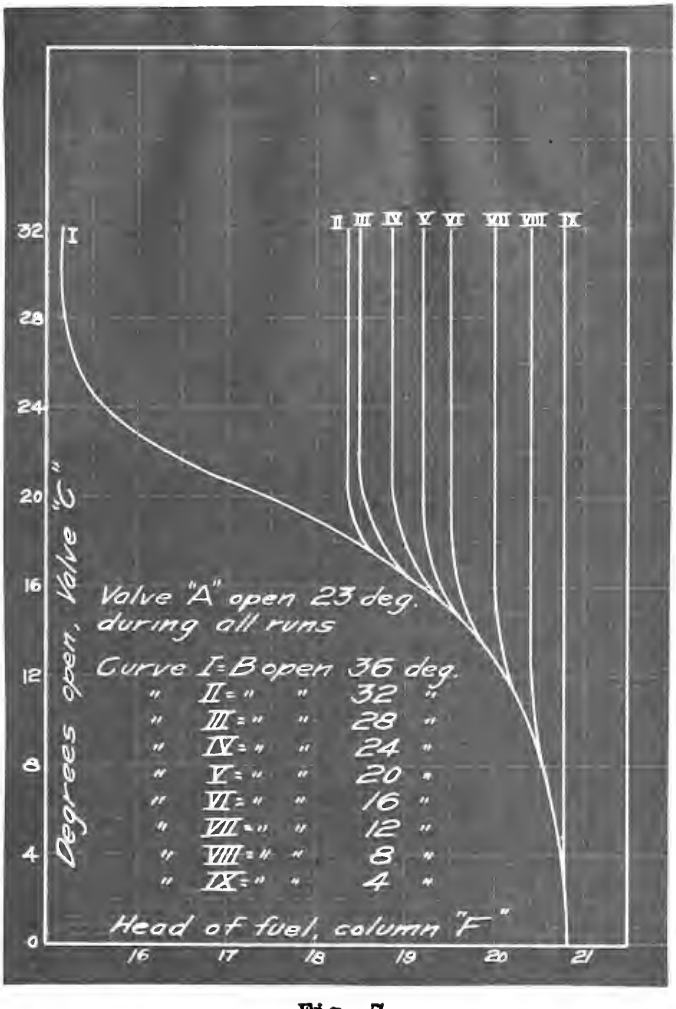

Degrees open, Valve "C"
32
28
24
20
16
12
8
4
0
I
II III IV V VI VII VIII IX
Valve "A" open 23 deg.
during all runs
Curve I = B open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
Head of fuel, column "F"
16
17
18
19
20
21

Fig. 7.

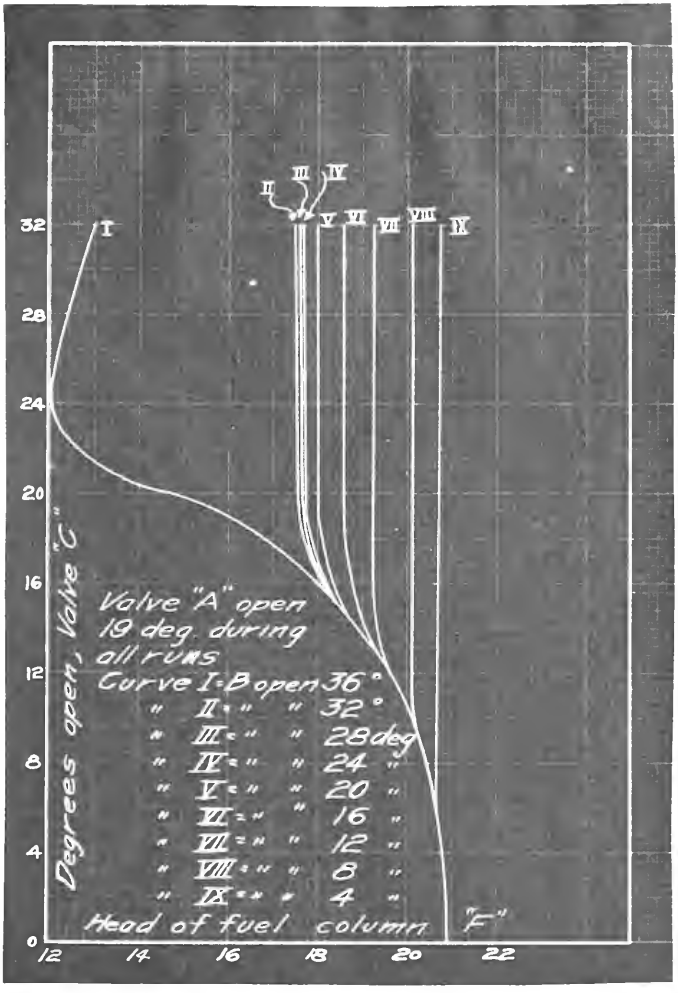

Degrees open, Valve "C"
Valve "A" open
19 deg. during
all runs
Curve I = B open 36°
" II = " " 32°
" III = " " 28 deg
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
Head of fuel column "F"
I
II
III
IV
V
VI
VII
VIII
IX
0
4
8
12
16
20
24
28
32
12
14
16
18
20
22

Fig. 8.

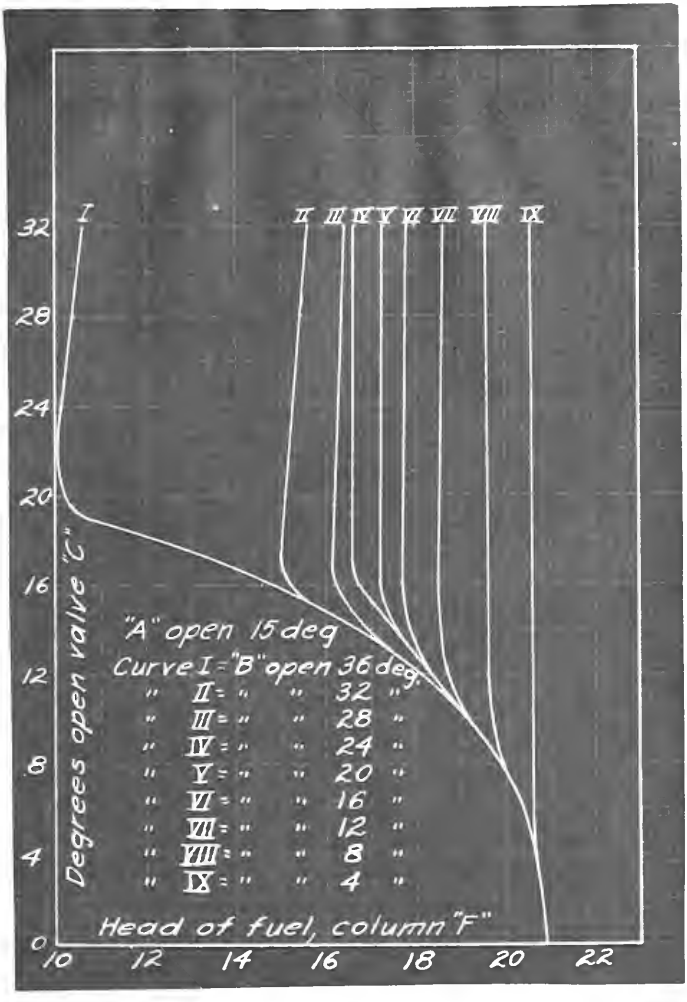

I
II
III
IV
V
VI
VII
VIII
IX
32
28
24
20
16
12
8
4
0
10
12
14
16
18
20
22
Degrees open valve "C"
Head of fuel, column "F"
"A" open 15 deg
Curve I = "B" open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "

Fig. 9.

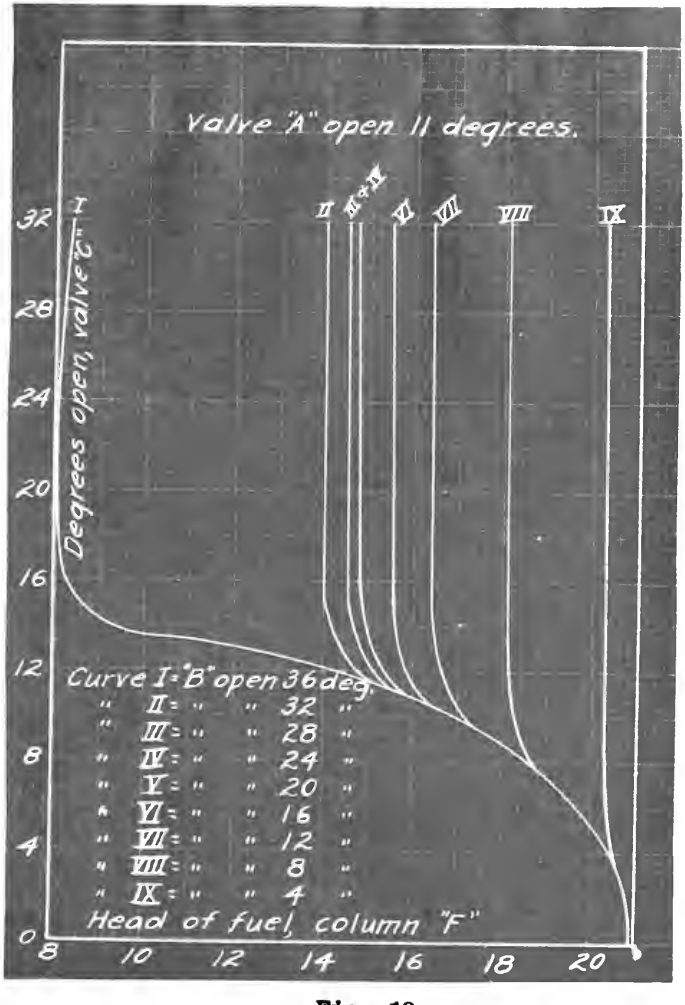

Valve "A" open 11 degrees.
Degrees open, valve "C"
Curve I = "B" open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
Head of fuel, column "F"
0
4
8
12
16
20
24
28
32
8
10
12
14
16
18
20

Fig. 10.

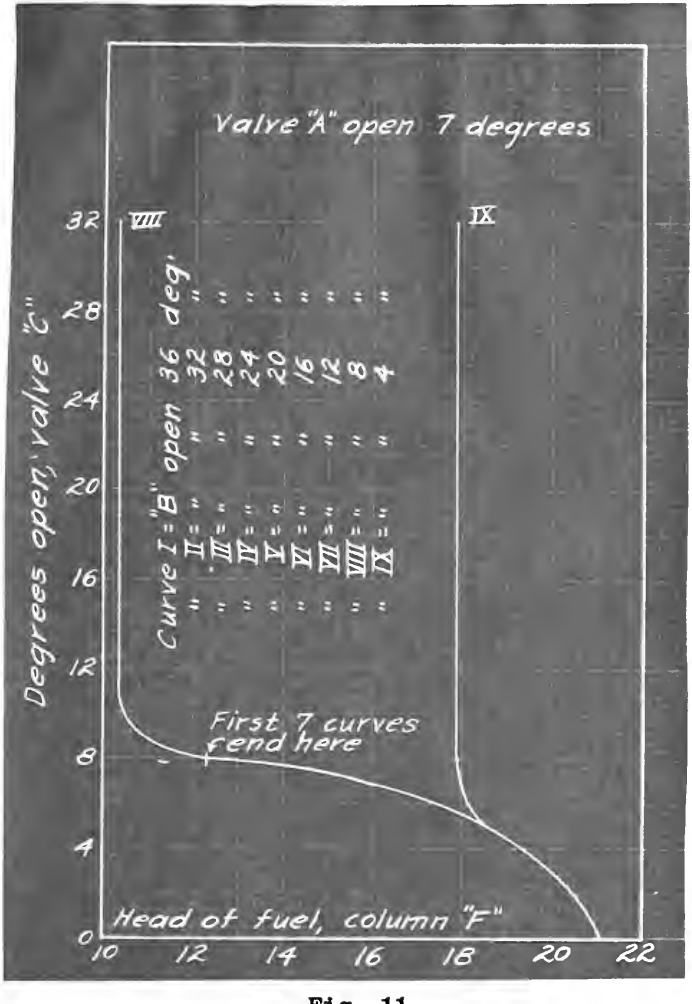

Valve "A" open 7 degrees
VIII
IX
Curve I "B" open 36 deg.
32
28
24
20
16
12
8
4
II
III
IV
V
VI
VII
VIII
IX
First 7 curves end here
Degrees open, valve "C"
Head of fuel, column "F"
0
4
8
12
16
20
24
28
32
10
12
14
16
18
20
22

Fig. 11.

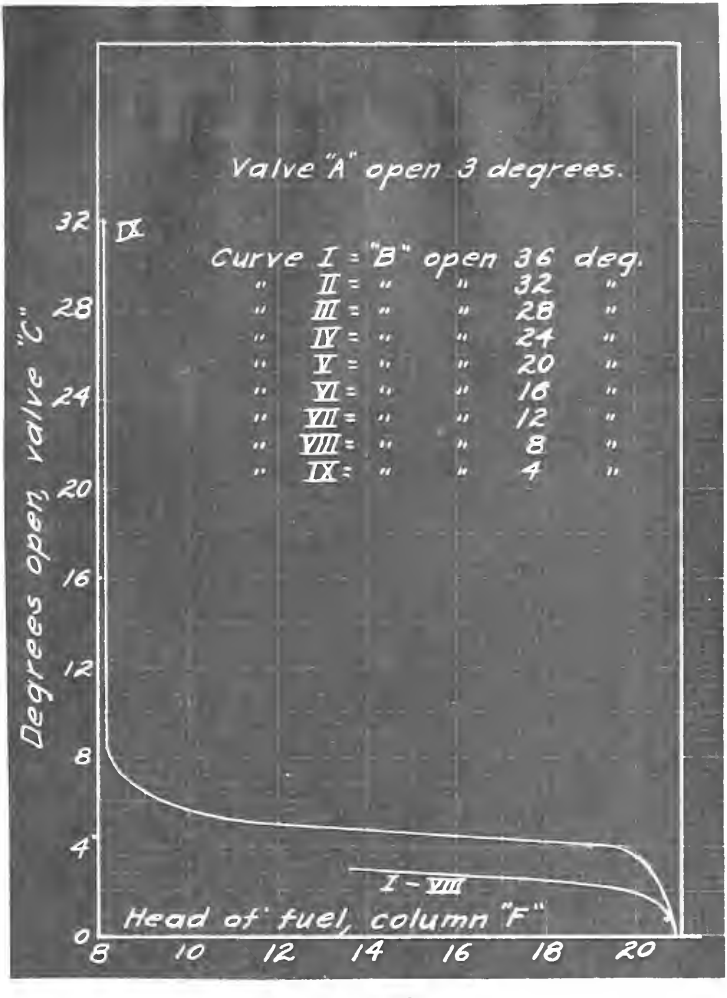

Valve "A" open 3 degrees.
Curve I = "B" open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
IX
I - VIII
Degrees open, valve "C"
Head of fuel, column "F"
0
4
8
12
16
20
24
28
32
8
10
12
14
16
18
20

Fig. 12.

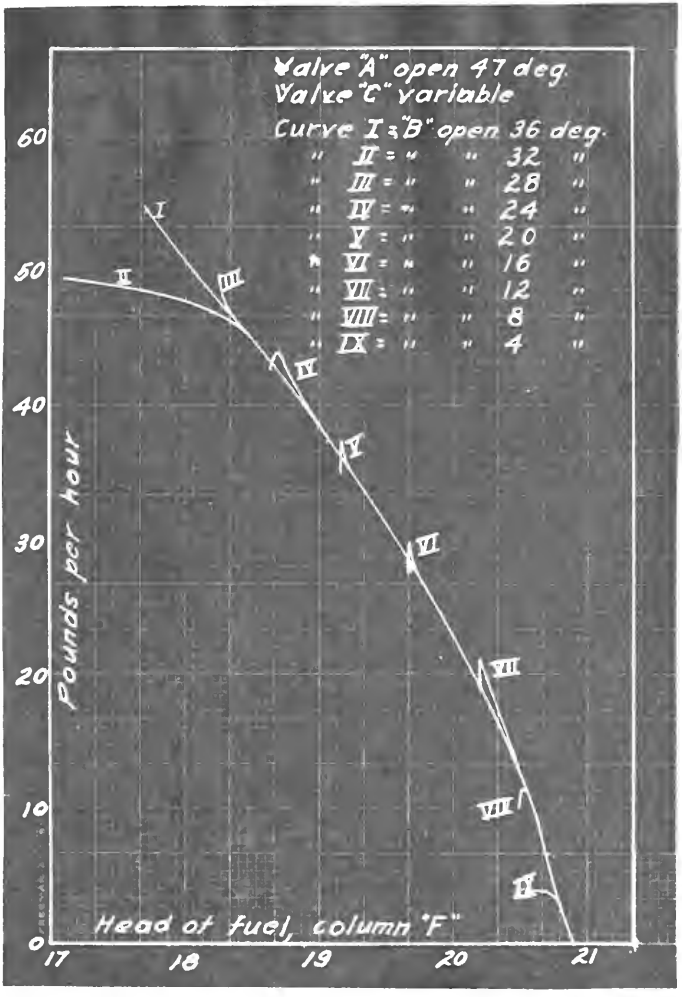

Valve "A" open 47 deg.
Valve "C" variable
Curve I = "B" open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
Pounds per hour
Head of fuel, column "F"
0
10
20
30
40
50
60
17
18
19
20
21

Fig. 13.

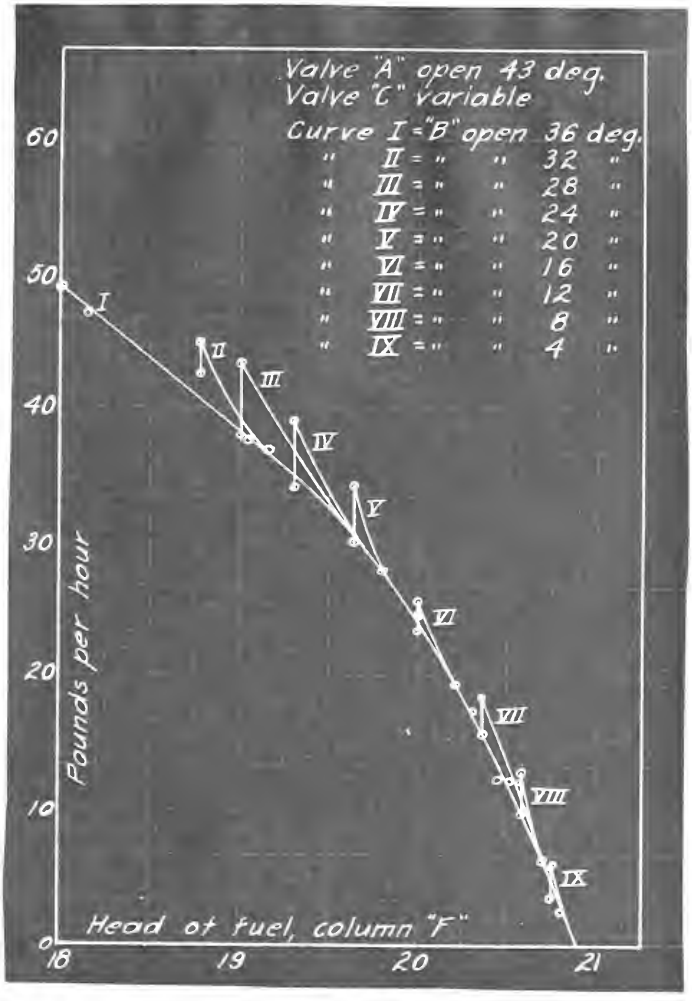

Valve "A" open 43 deg.
Valve "C" variable
Curve I = "B" open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
Pounds per hour
Head of fuel, column "F"
0
10
20
30
40
50
60
18
19
20
21
I
II
III
IV
V
VI
VII
VIII
IX

Fig. 14.

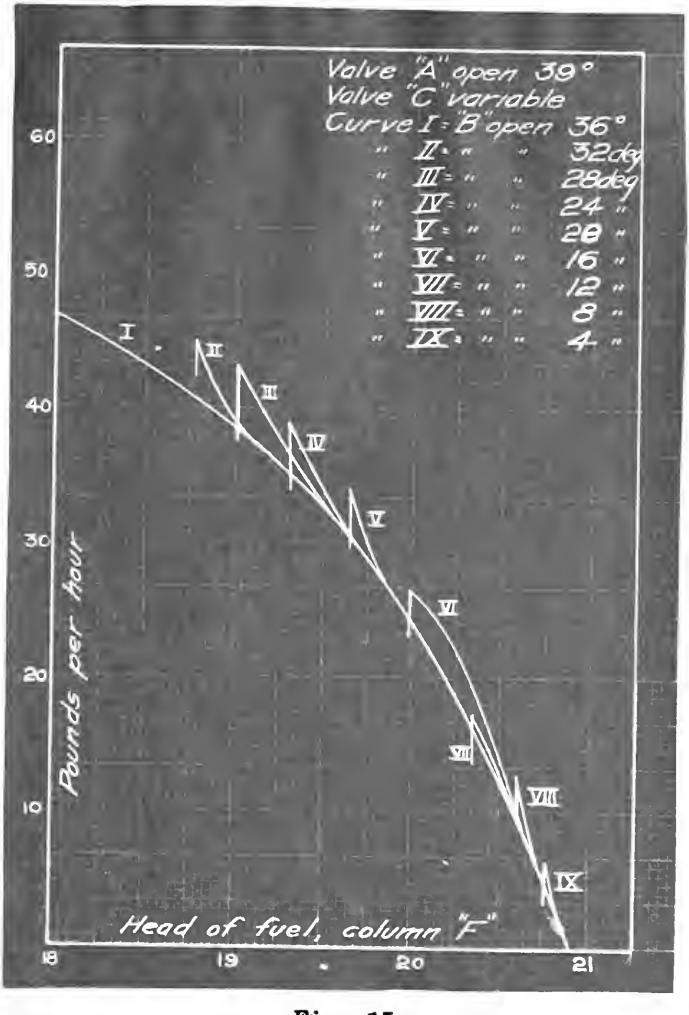

Valve "A" open 39°
Valve "C" variable
Curve I = "B" open 36°
" II = " " 32deg
" III = " " 28deg
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
Pounds per hour
Head of fuel, column "F"
60
50
40
30
20
10
18
19
20
21
I
II
III
IV
V
VI
VII
VIII
IX

Fig. 15.

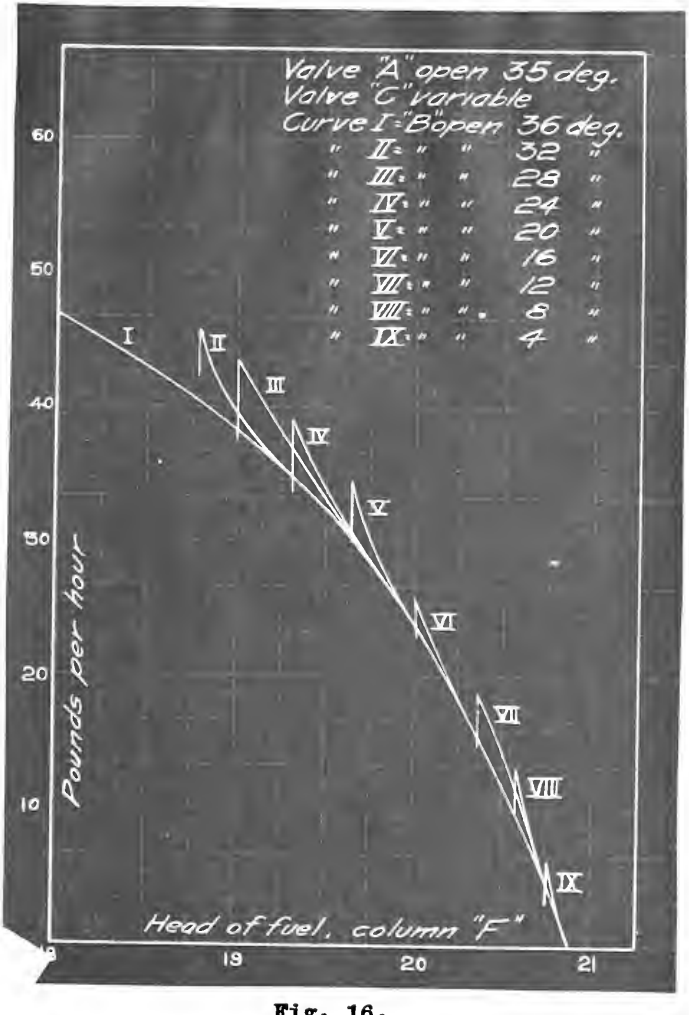

Valve "A" open 35 deg.
Valve "C" variable
Curve I = "B" open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
I
II
III
IV
V
VI
VII
VIII
IX
60
50
40
30
20
10
Pounds per hour
Head of fuel, column "F"
18
19
20
21

Fig. 16.

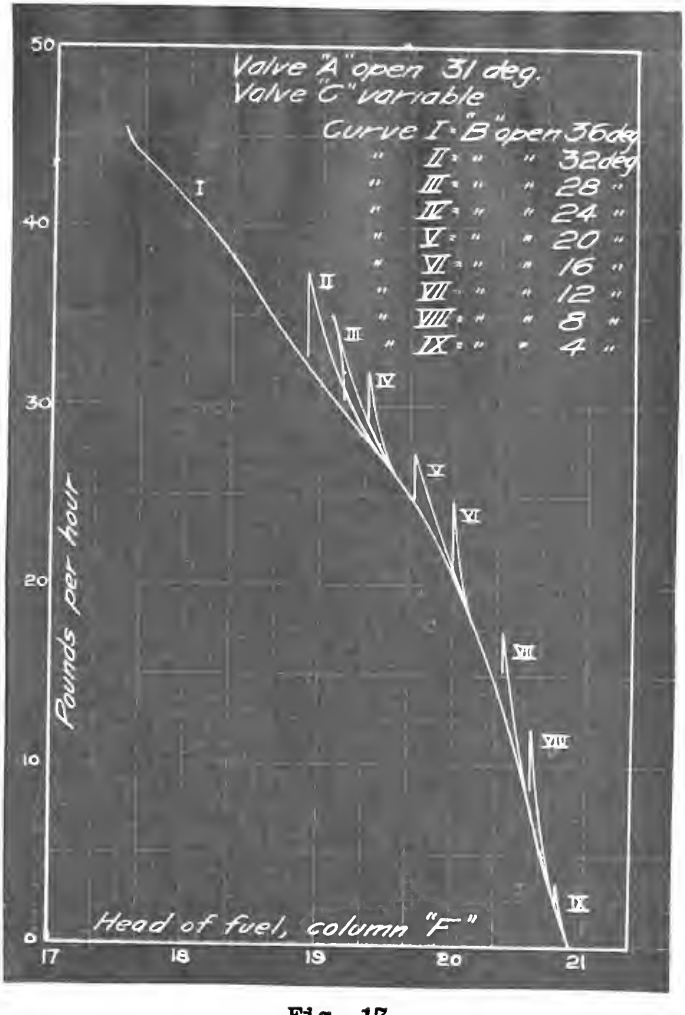

Valve "A" open 31 deg.
Valve "C" variable
Curve I = "B" open 36 deg
" II = " " 32 deg
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
Pounds per hour
Head of fuel, column "F"
0
10
20
30
40
50
17
18
19
20
21

Fig. 17.

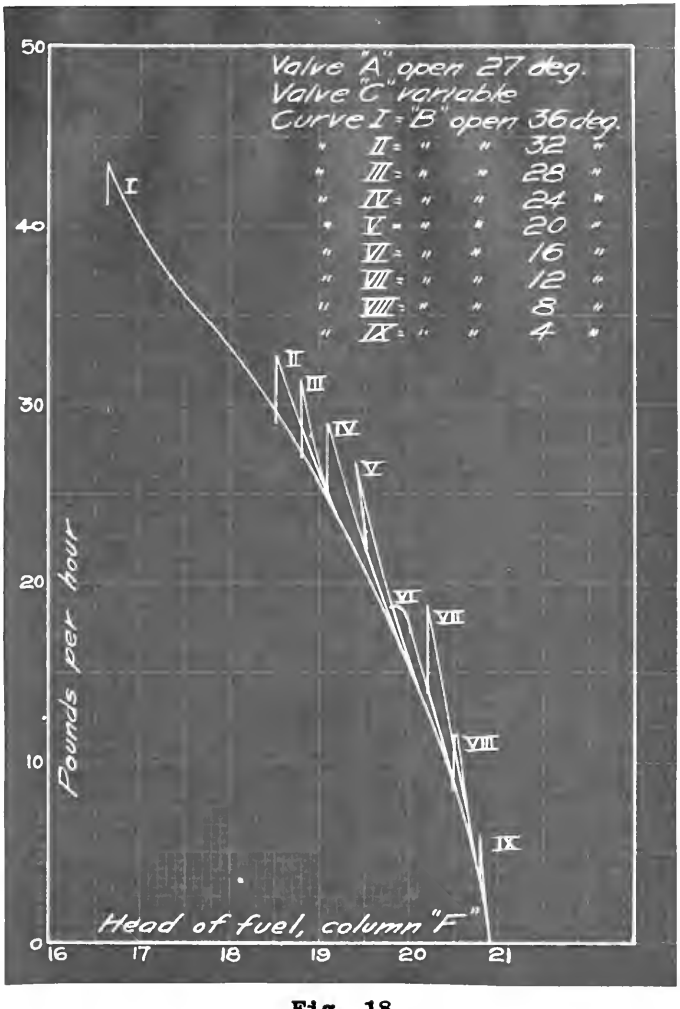

Valve "A" open 27 deg.
Valve "C" variable
Curve I = "B" open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
Pounds per hour
Head of fuel, column "F"
0
10
20
30
40
50
16
17
18
19
20
21
I
II
III
IV
V
VI
VII
VIII
IX

**Fig. 18.**

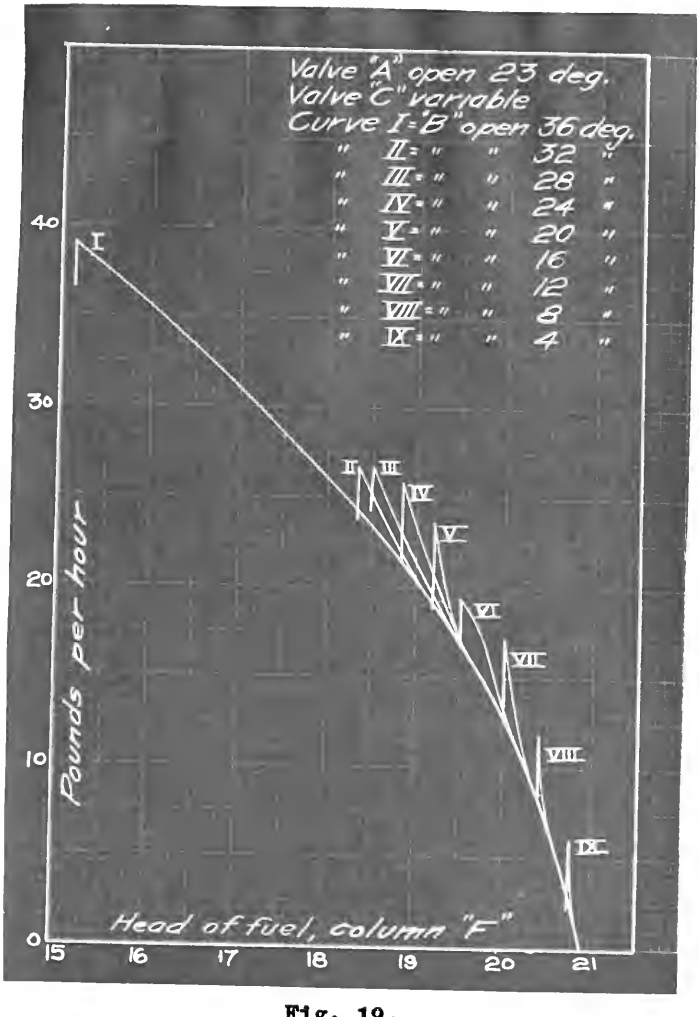

Valve "A" open 23 deg.
Valve "C" variable
Curve I = "B" open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
Pounds per hour
Head of fuel, column "F"
0
10
20
30
40
15
16
17
18
19
20
21
I
II
III
IV
V
VI
VII
VIII
IX

Fig. 19.

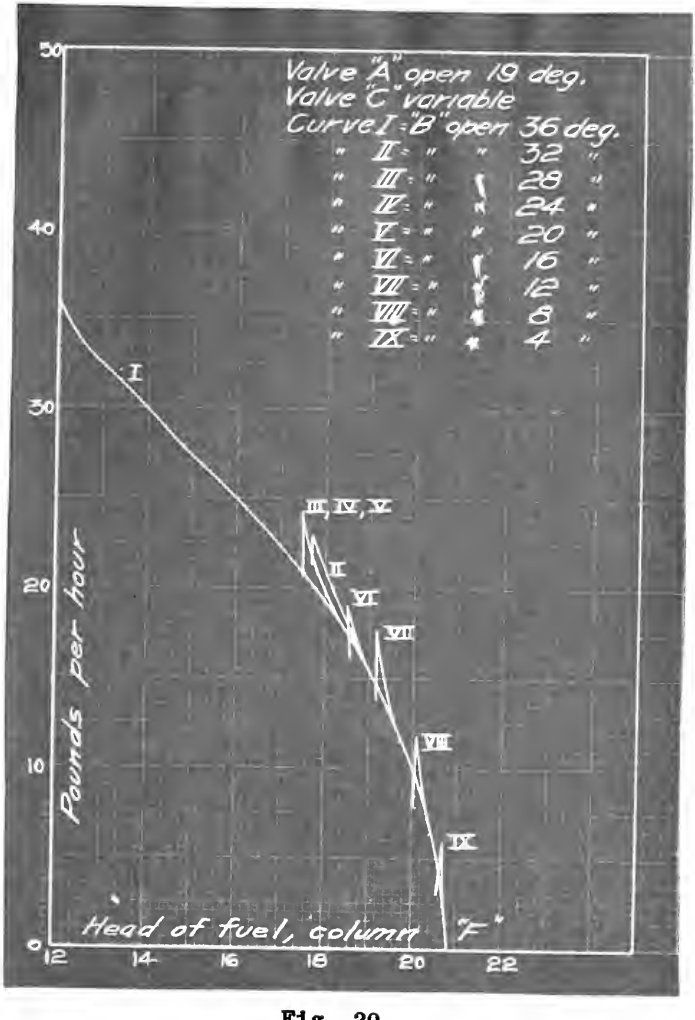

Valve "A" open 19 deg.
Valve "C" variable
Curve I = "B" open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
Pounds per hour
Head of fuel, column "F"
0
10
20
30
40
50
12
14
16
18
20
22
I
II
III, IV, V
VI
VII
VIII
IX

Fig. 20.

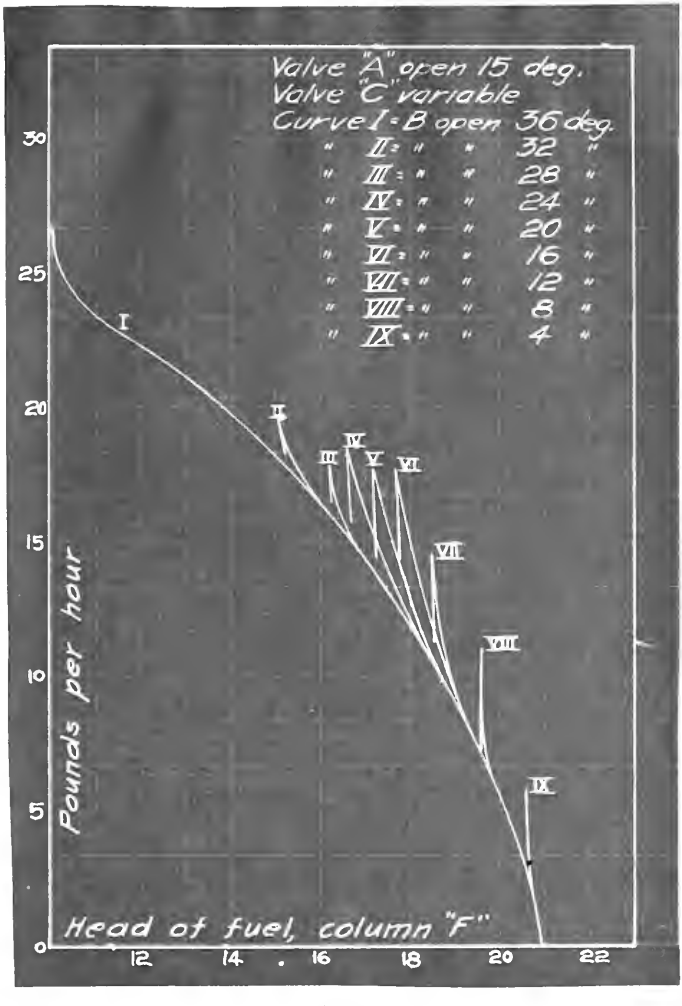

Valve "A" open 15 deg.
Valve "C" variable
Curve I = B open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
Pounds per hour
Head of fuel, column "F"
0
5
10
15
20
25
30
12
14
16
18
20
22
I
II
III
IV
V
VI
VII
VIII
IX

Fig. 21.

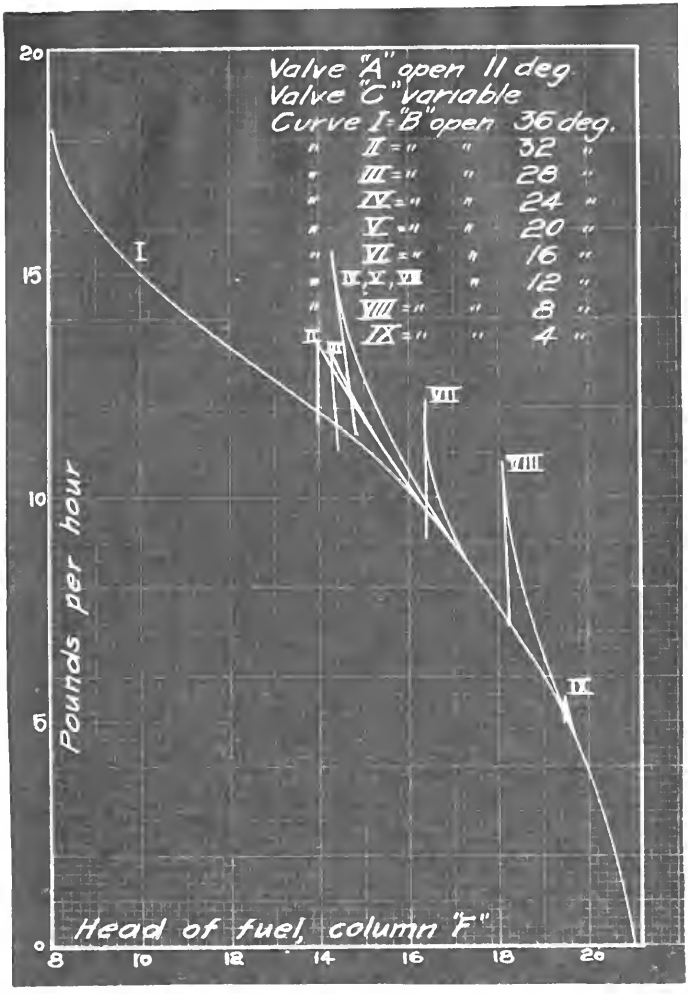

Valve "A" open 11 deg
Valve "C" variable
Curve I = "B" open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" IV, V, VI " 12 "
" VII = " " 8 "
" IX = " " 4 "
I
II
III
VII
VIII
IX
Pounds per hour
Head of fuel, column "F"
0
5
10
15
20
8
10
12
14
16
18
20

Fig. 22.

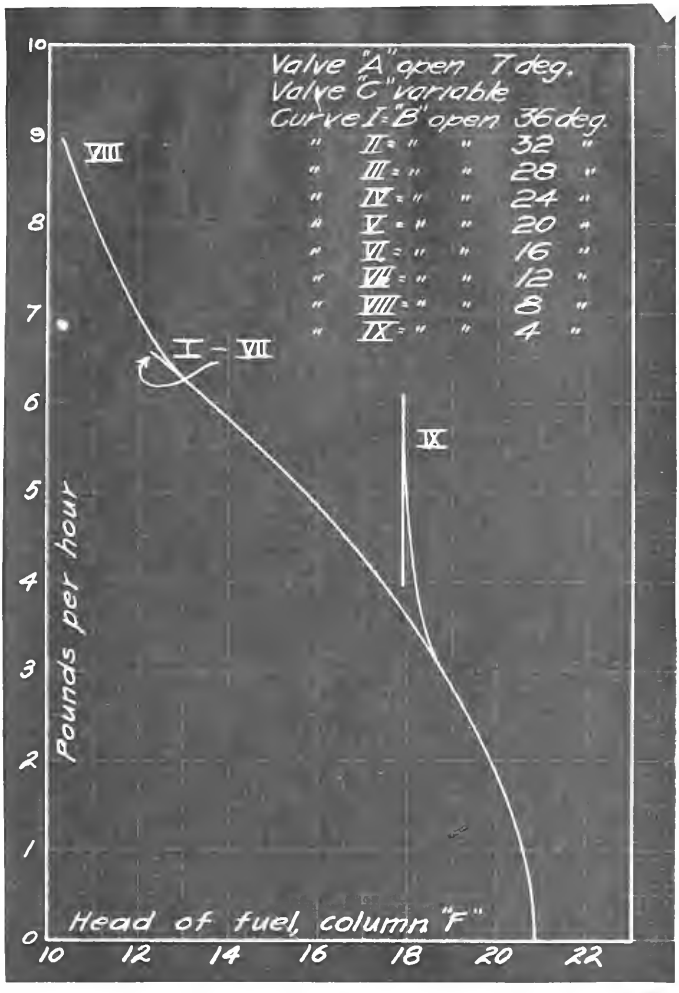

Valve "A" open 7 deg.
Valve "C" variable
Curve I = "B" open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
VIII
I - VII
IX
Pounds per hour
Head of fuel, column "F"
0
1
2
3
4
5
6
7
8
9
10
10
12
14
16
18
20
22

Fig. 23.

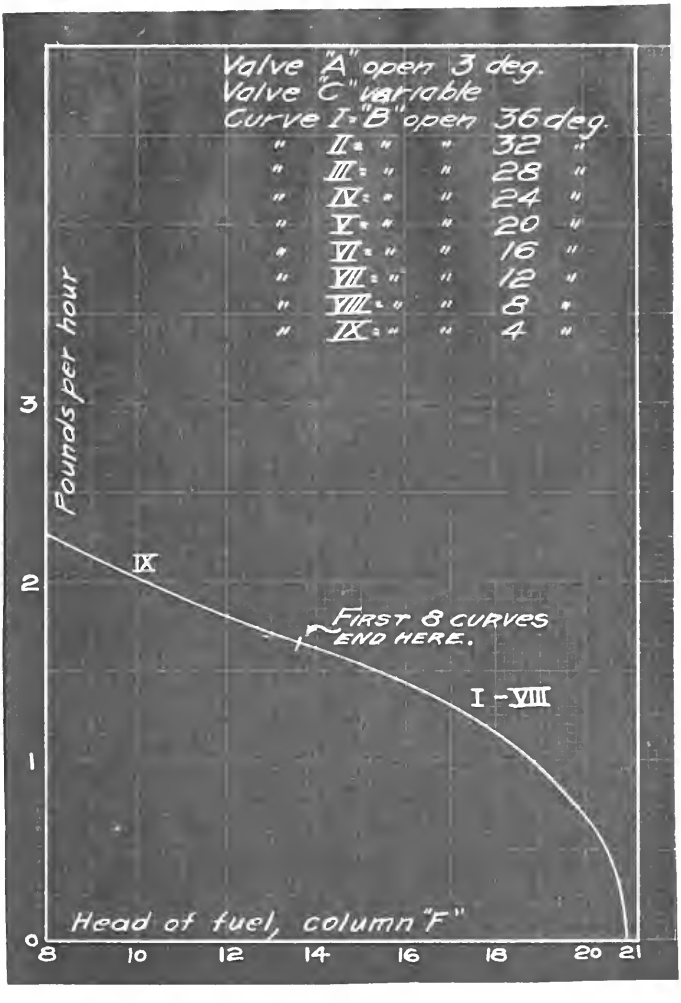

Valve "A" open 3 deg.
Valve "C" variable
Curve I = "B" open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
Pounds per hour
3
2
1
0
IX
FIRST 8 CURVES END HERE.
I - VIII
Head of fuel, column "F"
8
10
12
14
16
18
20
21

Fig. 24.

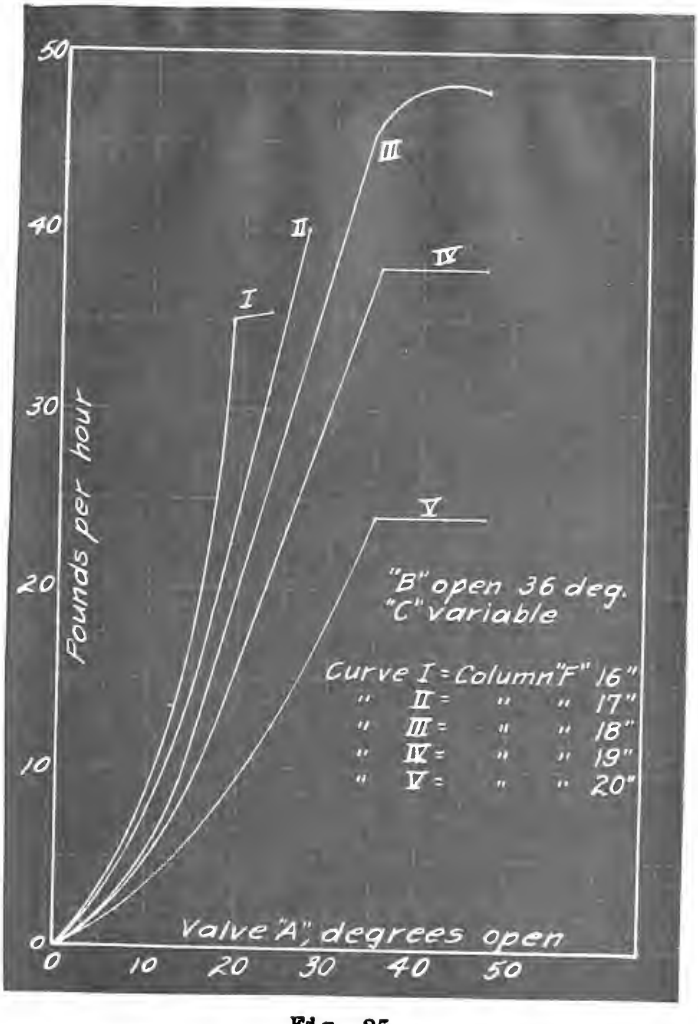

50
40
30
20
10
0
Pounds per hour
I
II
III
IV
V
"B" open 36 deg.
"C" variable
Curve I = Column "F" 16"
" II = " " 17"
" III = " " 18"
" IV = " " 19"
" V = " " 20"
Valve "A", degrees open
0
10
20
30
40
50

Fig. 25.

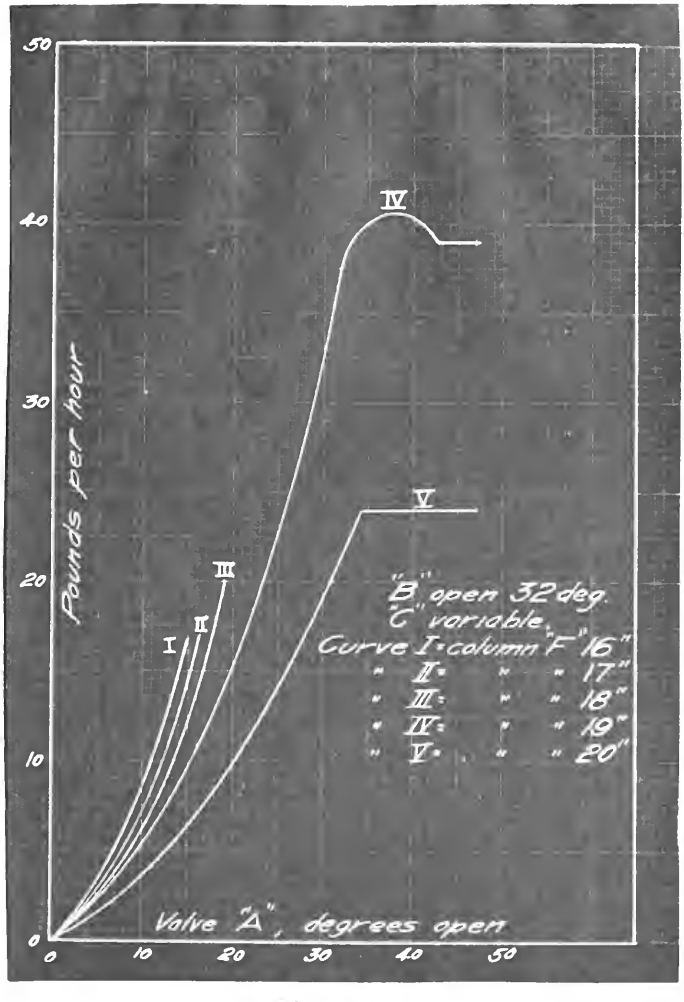

50
40
30
20
10
0
Pounds per hour
IV
V
III
II
I
"B" open 32 deg.
"C" variable.
Curve I = column "F" 16"
" II = " " 17"
" III = " " 18"
" IV = " " 19"
" V = " " 20"
Valve "A", degrees open
0
10
20
30
40
50

**Fig. 26.**

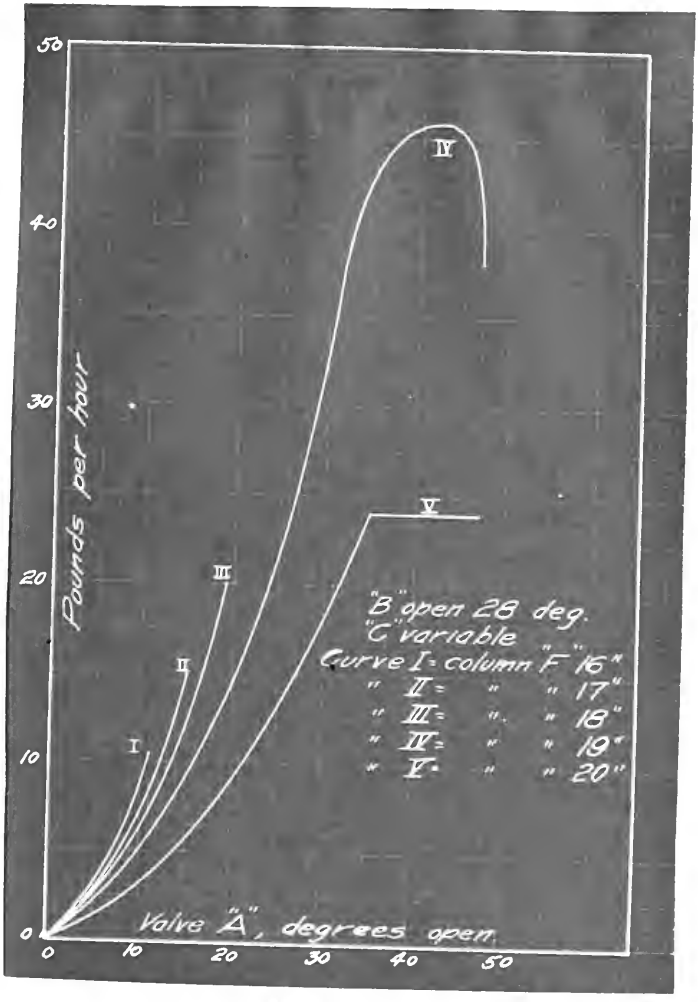

Pounds per hour
Valve "A", degrees open
"B" open 28 deg.
"C" variable
Curve I = column "F" 16"
" II = " " 17"
" III = " " 18"
" IV = " " 19"
" V = " " 20"
I
II
III
IV
V
0
10
20
30
40
50

Fig. 27.

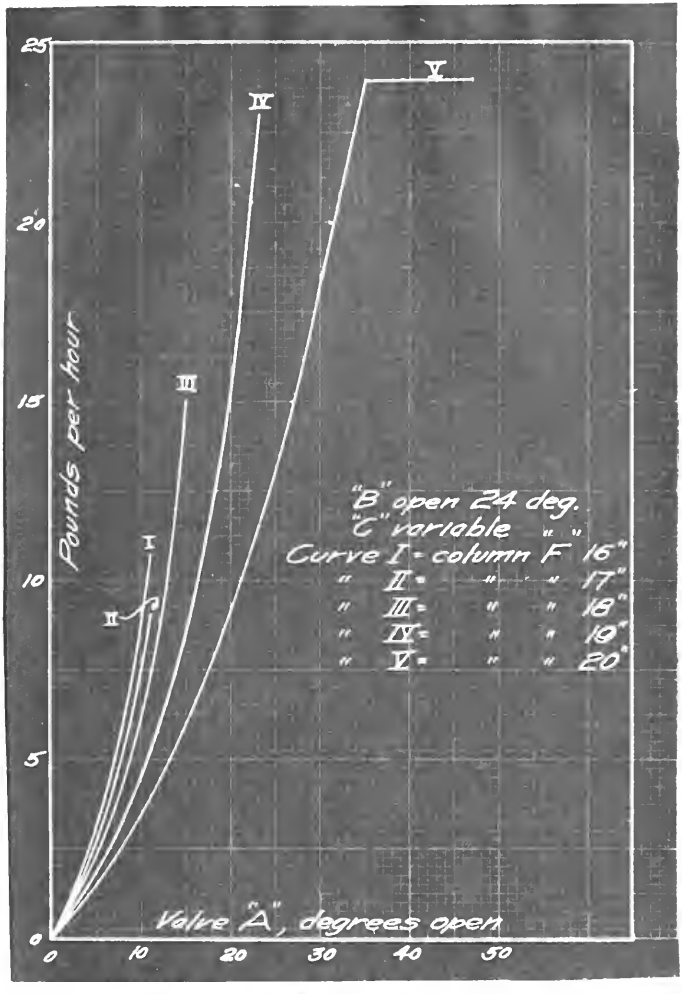

25
20
15
10
5
0
Pounds per hour
0
10
20
30
40
50
Valve "A", degrees open
I
II
III
IV
V
"B" open 24 deg.
"C" variable " "
Curve I = column F 16"
" II = " " " 17"
" III = " " 18"
" IV = " " 19"
" V = " " 20"

Fig. 28.

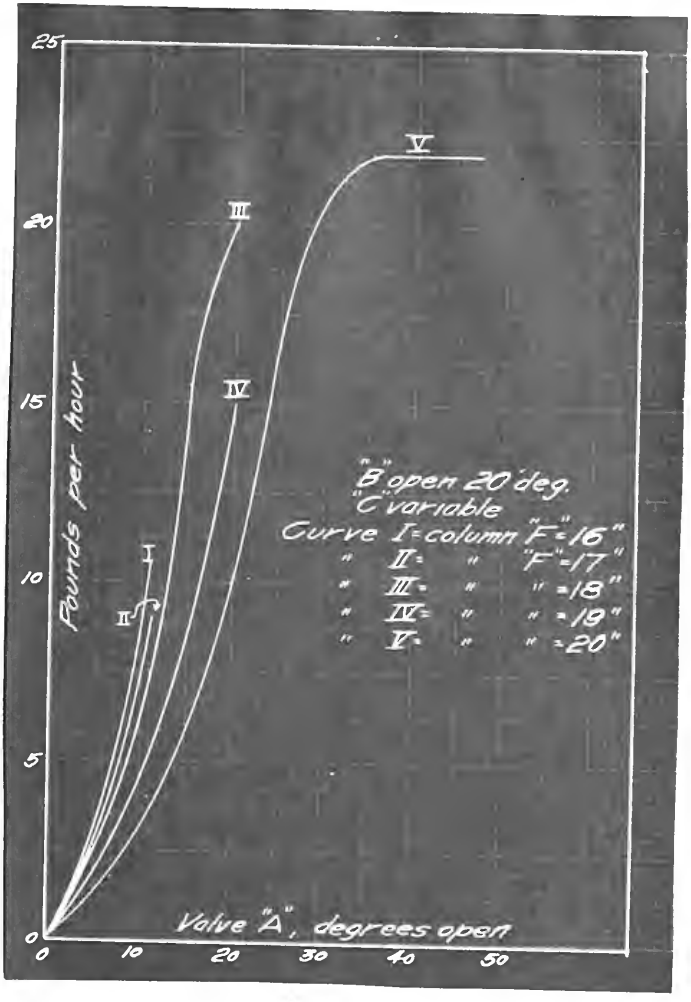

25
20
15
10
5
0
Pounds per hour
0
10
20
30
40
50
Valve "A", degrees open
I
II
III
IV
V
"B" open 20 deg.
"C" variable
Curve I = column "F" = 16"
" II = " "F" = 17"
" III = " " = 18"
" IV = " " = 19"
" V = " " = 20"

Fig. 29.

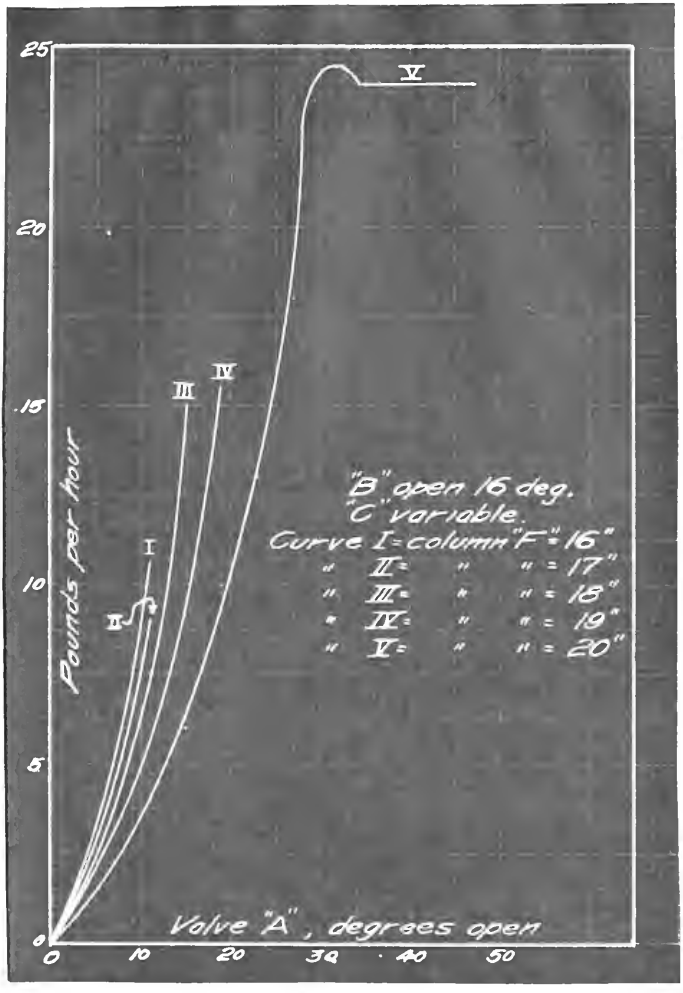

25
20
15
10
5
0
Pounds per hour
0
10
20
30
40
50
Valve "A", degrees open
I
II
III
IV
V
"B" open 16 deg.
"C" variable.
Curve I = column "F" = 16"
" II = " " = 17"
" III = " " = 18"
" IV = " " = 19"
" V = " " = 20"

Fig. 30.

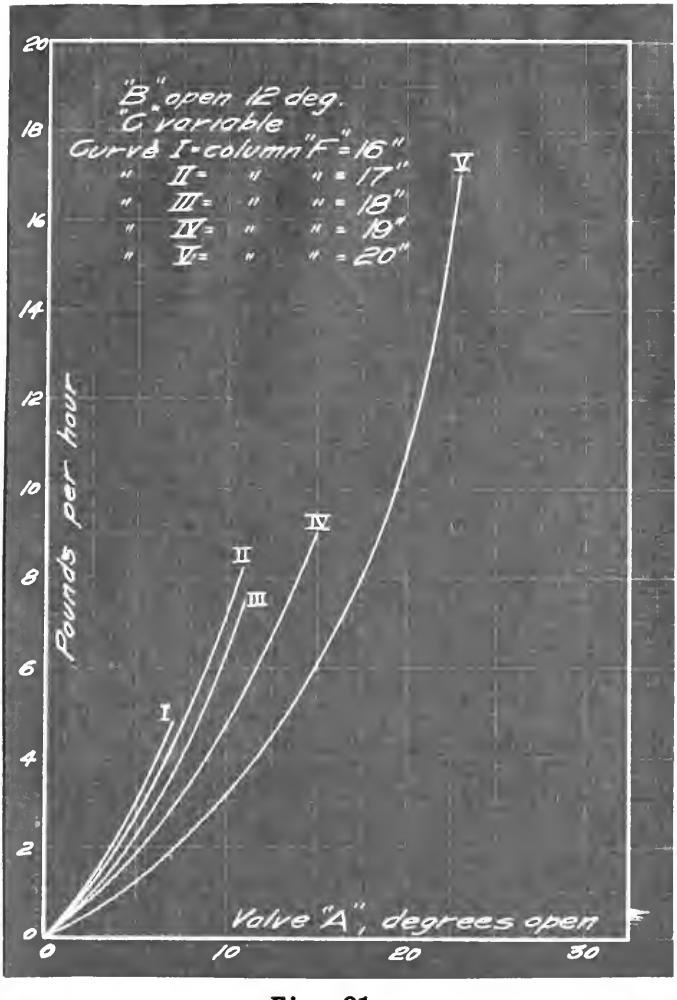

"B" open 12 deg.
"C" variable
Curve I - column "F" = 16"
" II = " " = 17"
" III = " " = 18"
" IV = " " = 19"
" V = " " = 20"
Pounds per hour
Valve "A", degrees open
0
2
4
6
8
10
12
14
16
18
20
0
10
20
30
I
II
III
IV
V

Fig. 31.

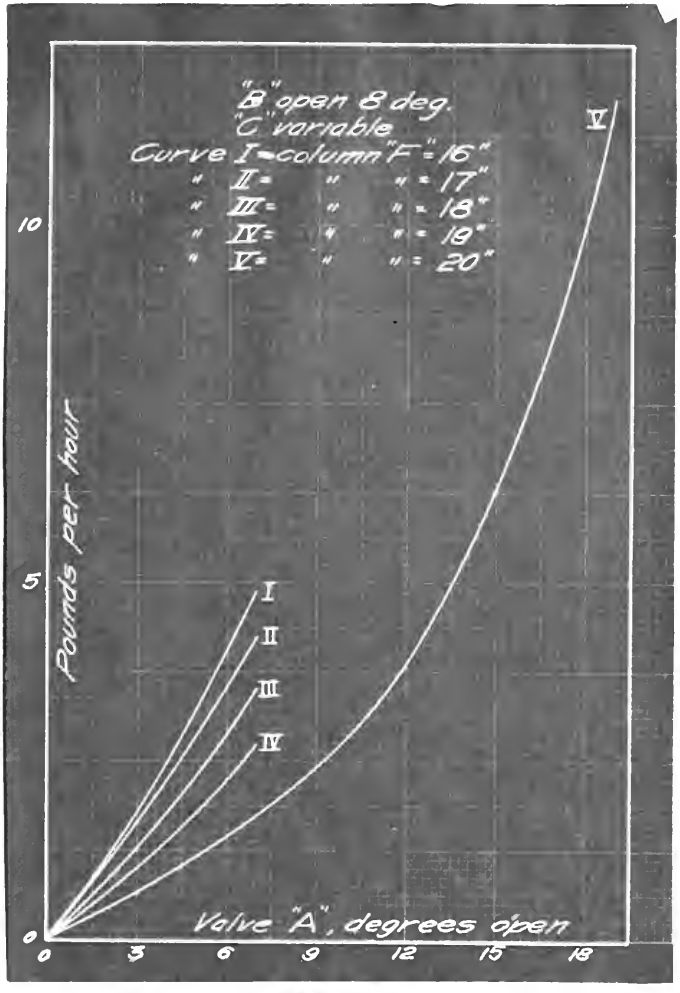

"B" open 8 deg.
"C" variable
Curve I = column "F" = 16"
" II = " " = 17"
" III = " " = 18"
" IV = " " = 19"
" V = " " = 20"
Pounds per hour
Valve "A", degrees open
0
5
10
0
3
6
9
12
15
18
I
II
III
IV
V

Fig. 32.

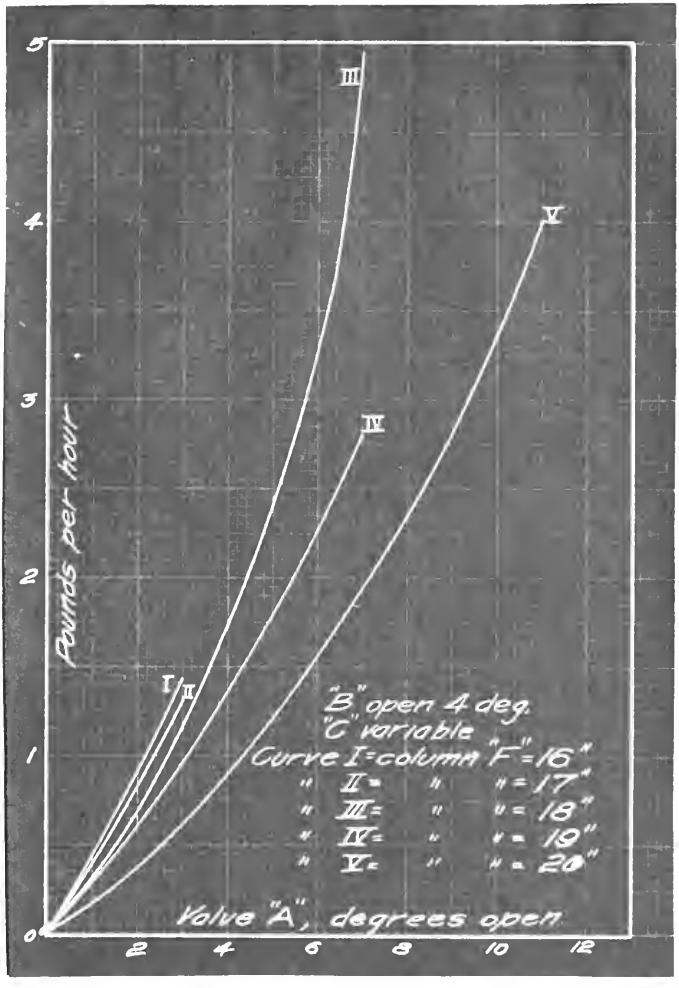

Pounds per hour
Valve "A", degrees open
"B" open 4 deg.
"C" variable
Curve I = column "F" = 16"
" II = " " = 17"
" III = " " = 18"
" IV = " " = 19"
" V = " " = 20"
I
II
III
IV
V
0
1
2
3
4
5
2
4
6
8
10
12

Fig. 33.

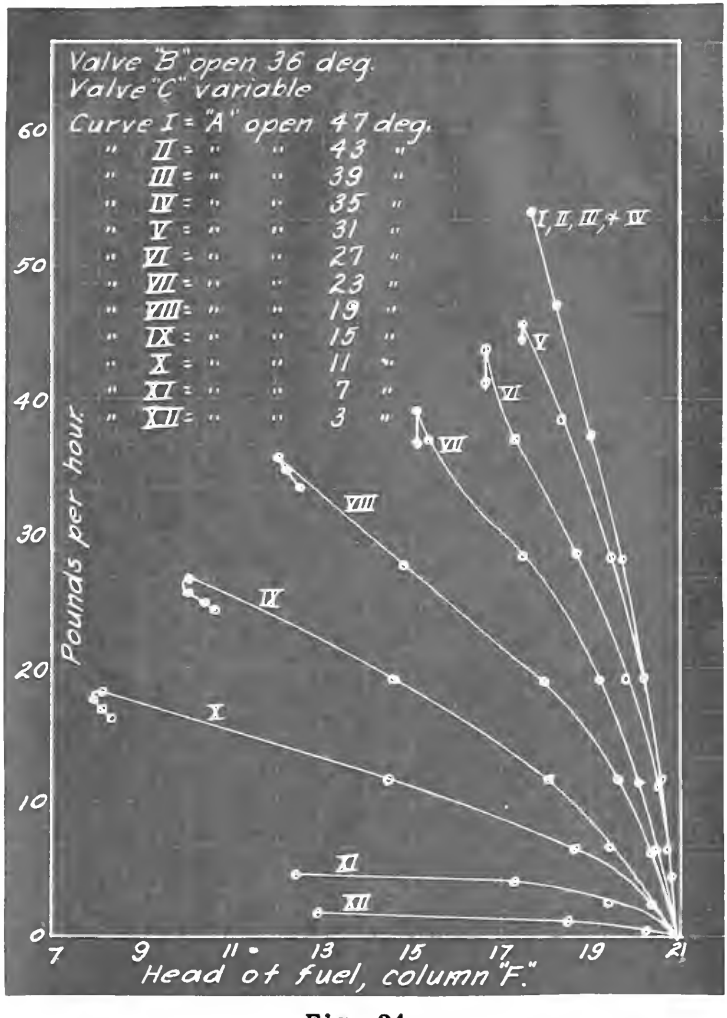

Valve "B" open 36 deg.
Valve "C" variable
Curve I = "A" open 47 deg.
" II = " " 43 "
" III = " " 39 "
" IV = " " 35 "
" V = " " 31 "
" VI = " " 27 "
" VII = " " 23 "
" VIII = " " 19 "
" IX = " " 15 "
" X = " " 11 "
" XI = " " 7 "
" XII = " " 3 "
I, II, III, + IV
V
VI
VII
VIII
IX
X
XI
XII
Pounds per hour.
0
10
20
30
40
50
60
7
9
11
13
15
17
19
21
Head of fuel, column "F."

Fig. 34.

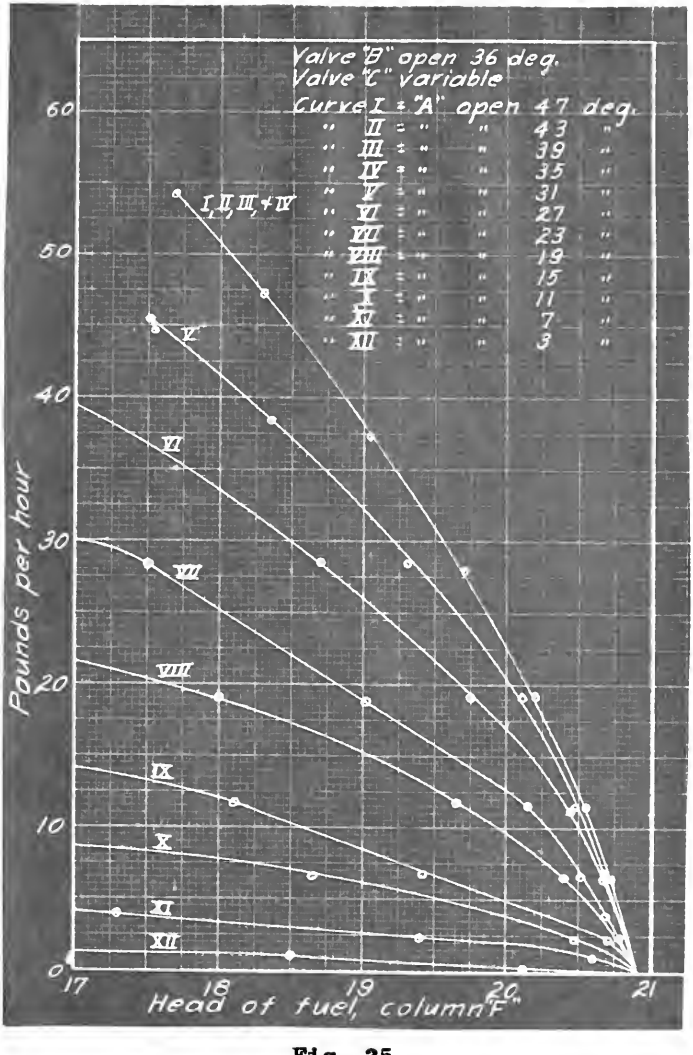
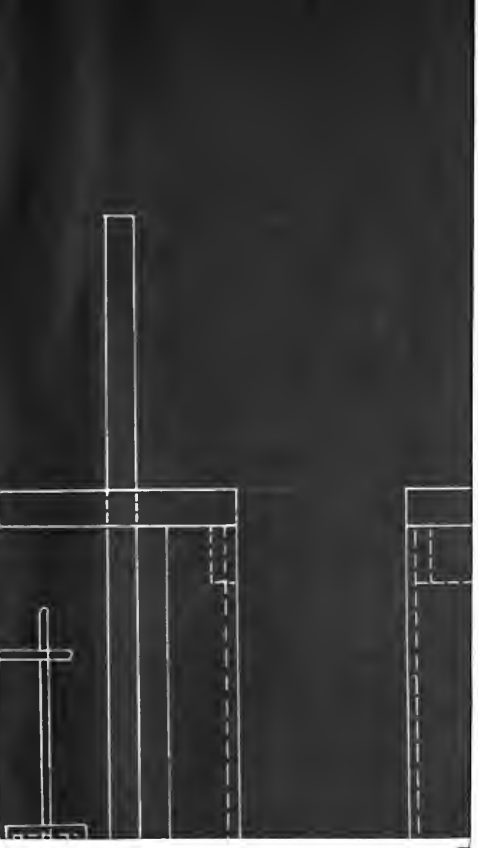

Valve "B" open 36 deg.
Valve "C" variable
Curve I = "A" open 47 deg.
" II = " " 43 "
" III = " " 39 "
" IV = " " 35 "
" V = " " 31 "
" VI = " " 27 "
" VII = " " 23 "
" VIII = " " 19 "
" IX = " " 15 "
" X = " " 11 "
" XI = " " 7 "
" XII = " " 3 "
I, II, III, + IV
V
VI
VII
VIII
IX
X
XI
XII
Pounds per hour
0
10
20
30
40
50
60
17
18
19
20
21
Head of fuel, column "F"

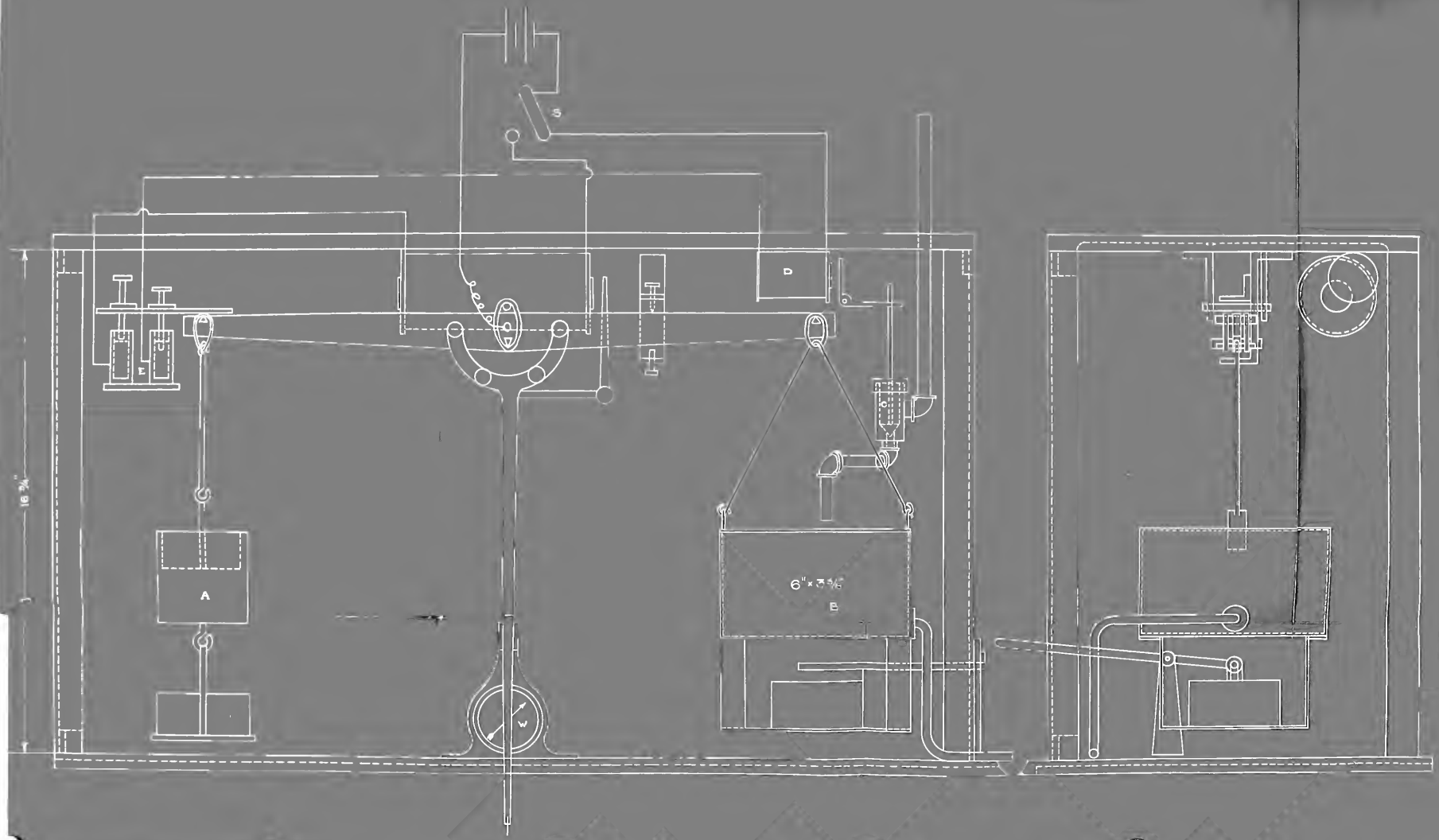
Fig. 35.

# PART V11.

## Conclusion.

The preceeding data and curves show that and apparatus such as was used, can be used succesfully in determing the amount of oil which an engine is using at any instant, by referring to the proper curve as shown in Part VI..




S
D
E
A
B
W
16 3/4"

T 29094
q532.52 M34

Marks, Milton

Flow of liquid fuel through orifices

T
q532.52 29094 M34

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